Army Code No. 71419
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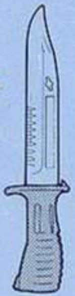

Infantry Training
Volume X
Vehicles and Vehicle Mounted Weapon Systems

Pamphlet No. 52

30 mm L21A1 Rarden and L37 GPMG CVR(W) Fox/CVR(T) Scimitar

1987

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INFANTRY TRAINING
Volume X

Vehicles and Vehicle Mounted Weapon Systems

Pamphlet No 52

30 mm L21A1 Rarden and L37 GPMG
CVR(W) FOX/CVR(T) SCIMITAR

1987

AMENDMENT No 2

MANUSCRIPT AMENDMENTS

Page 1–1.	Paragraph 0104. ***Stores.*** Line 9. *Delete "L5, L7"* and *substitute "L1A1 and/or".*
Page 2–1.	Paragraph 0204. ***Stores.*** Line 8. *Delete "L5, L7"* and *substitute "L1A1 and/or".*
Page 2–3.	Paragraph 0213.**d.** Line 1. *Delete* from "Stowage" to "pistol".
Page 3–11.	Paragraph 0338. *Delete* "Three" and *substitute* "Four".
Page 3–43.	Fig 12. After F1 (10A) *delete* all detail and *substitute* "Spare".
	After "F2 (10A) *delete* all detail and *substitute* "Spare".
Page 3–44.	Fig 13. After "F4 (10A) Traverse indicator illumination" *insert* "(where fitted)".
Page 4–28.	Paragraph 0493.**c.** *Delete* all detail.
Page 5–25.	Fig 23. Caption. After "No 52, Mk 1" *substitute* "/Mk 2".

Page 5–26.	Fig 24. After "Fig 24. —" *delete* all detail and *substitute* "Sight Periscope, AV, No. 52. Mk 1 — Graticule Pattern".
Page 5–53.	Paragraph 05159.**c.** Line 2. *Delete* the word "drift" and *substitute* "sight off-set".

NEW PAGES

Remove and destroy pages as follows: Front Cover, Security Warning Notice, Title Page, iv to xvi, 1–3 to 1–6, 2–5, 2–6, 2–9 to 2–12, 2–15, 2–16, 3–1 to 3–10, 3–13, 3–14, 3–17 to 3–20, 3–31 to 3–38, 3–45 to 3–50, 4–13, 4–14, 5–3, 5–4, 5–7 to 5–16, 5–19 to 5–24, 5–26A, 5–26B, 5–29 to 5–32, 5–49, 5–50, 5–65, 5–66, 5A–1 to 5A–6, 7–21 to 7–24, 7–31 to 7–46 and *substitute* new pages attached.

Notes:

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MINISTRY OF DEFENCE
February 1992

Prepared under the direction of
The Chief of the General Staff

Army Code No. 71419
D/HQDT/18/28/13

Infantry Training Volume X

Vehicles and Vehicle Mounted Weapon Systems

Pamphlet No. 52

30 mm L21A1 Rarden and L37 GPMG CVR(W) Fox/CVR(T) Scimitar

Prepared under the direction

of the Chief of the General Staff

Ministry of Defence

December 1987

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1987

FOREWORD

This Infantry sponsored pamphlet is a new publication, in Volume X, Vehicles and Vehicle Mounted Weapon Systems. The handling drills for the 30 mm Rarden and the L37 General Purpose Machine Gun are related to CVR(W) Fox but apply equally to CVR(T) Scimitar. Additional detail for CVR(T) Scimitar is included.

Any unit wishing to propose amendments to this pamphlet is invited to write to the Infantry Representative, RAC Gunnery Wing, Lulworth Camp, Wareham, Dorset. Proposals will be given consideration and any resulting amendments will be submitted to Headquarters Director of Infantry for approval and publication.

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TECHNICAL DETAILS

Weapon Systems

1. ***Main Armament.*** ***Ordnance 30 mm Gun L21A1 (Rarden)***

Calibre	30 mm
Extreme Effective Range	2000 metres
Cyclic Rate of Fire	80 rounds per minute
Ammunition	Armour Piercing Discarding Sabot (APDS) High Explosive (HE) Practice (PRAC) Armour Piercing Secondary Effects (APSE)
Muzzle Velocities (MV)	APDS — 1175 metres per second (mps) HE — 1080 mps PRAC — 1080 mps APSE — 1080 mps

2. ***Co-axial Machine Gun.*** ***7.62 mm General Purpose Machine Gun, L37 A2/A1***

Calibre	7.62 mm
Cyclic Rate of Fire	750 rounds per minute (stabilized on gas port No. 2)
Extreme Effective Range	1100 metres cold barrel (tracer burnout) 800 metres hot barrel (tracer burnout) Further if strike is observed
Muzzle Velocity	850 mps

Sighting Systems CVR (W) Fox and CVR(T) Scimitar

3. ***Gunner.***

Sight Periscopic, Armoured Vehicle (AV), No. 52 Mk 1/Mk 2	
Magnification	x 1 – x 10
Field of View x 10	116 mils
Sight Periscopic, Armoured Vehicle Image Intensified (AV), L2A1	
Magnification	
Low Magnification	x 1.6
High Magnification	x 5.8
Field of View low magnification	498 mils
Field of View high magnification	142 mils

4. ***Commander*** (Fox only).

Sight Periscopic, Armoured Vehicle (AV), No. 68 Mk 1/Mk 2 (No. 75 Mk 1/Mk 2)

Magnification	x 1 – x 10
Field of View	116 mils

5. ***Commander*** (Scimitar only).

Sight Periscopic, Armoured Vehicle (AV), No. 75 Mk 1/Mk 2

Magnification	x 1 – x 10
Field of View x 10	116 mils

Periscopes

6. ***Fox.***

Nine Periscopes, Armoured Vehicle (AV), No. 43 Mk 3

7. ***Scimitar.***

Seven Periscopes, Armoured Vehicle (AV), No. 48 Mk 2
Two Periscopes, Armoured Vehicle (AV), No. 43 Mk 3

Boresighting

8. ***Sight Bore, Optical Cased No. 12 Mk 1.***

Magnification	x 7
Field of View	106 mils
Reticule Circle	18 mils arc
Reticule Dot	0.15 mils

Turret

9. ***Armament.***

Maximum Elevation	+ 710 mils from horizontal
Maximum Depression	– 178 mils from horizontal

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ASSOCIATED PUBLICATIONS

The pamphlet is to be read in conjunction with the following publications:

a. RAC Training Volume 3.

Pamphlet No. 31	The Application of Fire from Fox/Scimitar (Army Code No. 71314).
Pamphlet No. 35	CVR(W) Fox Armament Servicing Guide (Army Code No. 61176).
Pamphlet No. 39	Miniature Range Training — Fox.
Pamphlet No. 40	General Principles of Shooting from AFVs (Army Code No. 71305).
Pamphlet No. 43	AQUILINA Gunnery Simulator.

b. Infantry Training Pamphlets.

Army Code No. 71026	Volume II, Pamphlet No. 8 Part 1, GPMG (Lt).
Army Code No. 71080	Volume IV, Pamphlet No. 21, Range Conduct and Safety Rules.
Army Code No. 71053	Volume IV, Pamphlet No. 22, Range Construction and Regulations.

c. Army Equipment Support Publications.

Army Code No. 60975	User Handbook, Ordnance 30 mm Gun L21A1 (Rarden) — 1983.
Army Code No. 14557	User Handbook, Machine Gun 7.62 mm TKL8A1 and Machine Gun 7.62 mm L37A1.

ABBREVIATIONS

AESP	—	Army Equipment Support Publication
AFV	—	Armoured Fighting Vehicle
APDS	—	Armour Piercing Discarding Sabot
APSE	—	Armour Piercing Secondary Effects
AV	—	Anti-Vapour and Armoured Vehicle
CIM	—	Classroom Instructional Model
Co-ax	—	Coaxial (having a common axis)
CVR(T)	—	Combat Vehicle Reconnaissance (Tracked)
CVR(W)	—	Combat Vehicle Reconnaissance (Wheeled)
DAP	—	Distant Aiming Point
HE	—	High Explosive
II	—	Image Intensified
MBS	—	Muzzle Bore Sight
MBSGD	—	Multi Barrel Smoke Grenade Discharger
MV	—	Muzzle Velocity
PRAC	—	Practice
PRV	—	Pressure Relief Valve
QF	—	Quick Firing

Rarden	—	Royal Armoured Research and Development Establishment, (Enfield)
RF	—	Radio Frequency
rpm	—	rounds per minute
RVD	—	Residual Vapour Detector
SPW	—	Spare Parts Wallet
SWG	—	Static Water Gauge
UHE	—	Ultra High Efficiency

INFANTRY TRAINING

VOLUME X
VEHICLES AND VEHICLE MOUNTED WEAPON SYSTEMS

Pamphlet No. 52

30 mm RARDEN L21A1 AND GPMG L37
CVR(W) FOX/CVR(T) SCIMITAR

INTRODUCTION

Aim of the Pamphlet

1 The aim of this pamphlet is to teach the skills and techniques required by the commander and gunner to operate the 30 mm Rarden and GPMG L37 mounted in CVR(W) Fox or CVR(T) Scimitar.

Layout of the Pamphlet

2. The pamphlet, written in lesson form, is divided into chapters as follows:

   a. Chapter 1 and 2 give a general background to the Fox and Scimitar vehicles and provide an introduction to combat vehicles reconnaissance (CVR) for those soldiers who are not familiar with them. The lessons are to be taught to all ranks on receipt or take over of the vehicles.

   b. Chapter 3 contains the basic skills and information on 30 mm Rarden L21A1.

   c. Chapter 4 contains the basic skills and information on the General Purpose Machine Gun L37.

   d. Chapter 5 sets out the basic lessons on the turret, its contents and their operation.

   e. Chapter 6 consists of a guide to the conduct of revision periods and sets out specimen revision periods.

   f. Chapter 7 contains additional information for the instructor, the Training Tests and a glossary of terms.

3. Each lesson is divided into two parts:

   a. Part A — *Instructor's Notes.* This contains the information required by the instructor to enable him to prepare for the lesson.

   b. Part B — *Conduct of the Lesson.* This contains the subject matter to be taught and is laid out in a proven sequence.

4. Details printed in italics are instructions to the instructor.

Organization of Instruction

5. Instructors are allowed latitude in the method they adopt to teach the various lessons provided they do not deviate from the facts and drills laid down.

6. Revision periods are included to confirm that instruction has been assimilated. Re-teaching should only be necessary in exceptional circumstances. It is emphasized that basic teaching and practice without firing is boring for the soldier.

7. It should not be necessary to teach Lesson 13, the introduction to the 7.62 mm GPMG L37, to personnel already familiar with the gun in its FV 432 turret role.

8. The L37 machine gun has a special top cover that incorporates a feed pawl depressor. It is used, particularly, by Armoured Corps personnel during drills with machine guns mounted in their vehicles. As an aid to standardizing infantry gun drills the depressor is removed before instruction and firing but should be replaced before the gun is returned to store.

9. Before every lesson all guns, drill rounds and equipments are to be inspected to ensure that there are no live rounds present.

10. 30 mm and GPMG additional safety measures are necessary when live firing is involved. They are as follows:

a. The cartridge head space of each gun is to be checked by an armourer and a certificate rendered to the effect that it is correct.

b. Using normal pressure, the barrel latch is to be engaged with the barrel locking nut by at least three notches.

b. *Machine Gun.* A 7.62 mm GPMG L37 is mounted co-axially to the left of the main armament.

c. *Smoke Weapons.* Banks of dischargers, varying in number, are mounted on either side of the turret. These fire smoke grenades.

d. *Auxiliary Weapons.* Stowage for six grenades, which can be either extra hand thrown smoke grenades or anti-personnel hand grenades, is provided inside the turret. The stowage positions are taught in a later lesson.

0114. *Confirm by questions.*

Gun Controls

0115. *The instructor in the gunner's seat, one man in the commander's seat and the remainder on top of the vehicle. Explain and demonstrate:*

a. *Line Controls.* The gunner is provided with a traverse handle convenient to his right hand. The handle has an upper and lower position. When pushed upwards a high gear is engaged and when pulled downwards a low gear is engaged which is used for fine laying. The gunner is also provided with a mechanical traverse indicator which is situated on top of the traverse gearbox. This enables the gunner to apply line switches ordered by the commander.

b. *Elevation Controls.* The gunner is provided with an elevating handwheel convenient to his left hand. The handle incorporates an electrical firing switch.

0116. *Confirm by questions.*

Fire Control Equipment

0117. *Allow the squad to individually examine the controls. Explain and demonstrate:* The following equipment and switches are used in fire control:

a. *Battery Master Switch.* Provides power to the fire control equipment and is situated on the hull roof plate to the left of the driver. It is accessible from inside the turret.

b. *Selector Switch.* This is situated on the gun selector switch box to the front left of the gunner's position. The switch has three positions, 'Co-ax', 'Off' and 'Main'. A red light on the rearward facing side of the selector box illuminates when 'Main' or 'Co-ax' has been selected. Some gun selector switch boxes have two bezel lights, one orange to indicate 'Co-ax' and the other one red to indicate 'Main'.

c. *Firing Switch.* This is situated on the gunner's elevating handle. Pressure on the switch will activate a solenoid on either the 30 mm or co-axial GPMG, according to the position of the selector switch.

0118. *Confirm by questions.*

Observation Equipment and Sights

0119. *The instructor standing on the gunner's seat, the remainder standing around the turret. Explain and demonstrate:* The commander and gunner are provided for as follows:

a. *The Commander.*

(1) A sight periscopic, AV No 68 or No 75, has a x10 and a unity (x1) viewing system, together with a graticule pattern.

(2) Seven periscopes, AV No 43, are arranged around the commander's hatch which, together with the x1 system in his sight, give the commander an all round view when closed down.

b. *The Gunner.*

(1) A sight periscopic, AV No 52, has a x10 and a unity (x1) viewing system, together with a graticule pattern. For night vision, sight II L2A1 is used which has a x7 magnification.

(2) Two periscopes AV No 43, one each side of the sight.

0120. *Confirm by questions.*

Additional Equipment

0121. *The squad to individually examine the equipment. The instructor in the gunner's seat, one man in the commander's seat, the remainder on top of the vehicle. Point out and explain:*

a. The sight electrical control box.

b. The turret control and power supply box.

c. The drinking water tank and outlets.

d. The position of radios.

e. The smoke grenade discharger buttons.

f. The extractor fan, mounted to the left of the commander's periscope on the turret wall, will remove toxic fumes and smoke from the turret. A combined switch and control valve on the fan must be pulled out and rotated 90 degrees right or left to bring the fan into operation. The fuze protecting the circuit box is fuze F13 on the turret control and power supply box.

g. The fuel tap.

h. The position of the batteries.

0122. *Confirm by questions.*

Ammunition

0123. *Explain:* The following quantities of ammunition are carried:

a.	30 mm all natures	93 rounds
b.	7.62 mm 1:1 Tracer	2600 rounds (13 boxes)
c.	*Grenades.*	
	(1) For dischargers	16 x L8 grenades (8 in dischargers and 8 in boxes on the outside of the turret) ◄
	(2) Hand grenades	Stowage for a total of 6 grenades ◄

0124. *Confirm by questions.*

Crew Positions and Seats

0125. *Explain and demonstrate:* The following are the crew positions and duties:

a. *Commander.* Seated on the left hand side of the turret his duties are:

(1) To command the vehicle.

(2) To select targets and fire positions for the vehicle.

(3) To act as Fire Controller.

(4) To carry out the handling drills for the main armament and the co-axial GPMG.

b. *Gunner.* Seated on the right hand side of the turret his duties are:

(1) To fire the main armament and GPMG as directed by the commander.

(2) To assist the commander in observation and target selection.

c. *Driver.* Seated in the centre of the hull his duties are:

(1) To drive the vehicle.

(2) To assist the commander in his selection of vehicle fire positions.

(3) To service and maintain the vehicle.

(4) To act as a relief to the gunner.

0126. **Seating.** *Explain and demonstrate:* The operation of the seats.

0127. *Confirm by questions and practice.*

Conclusion

0128. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) Weapons and ammunition.

(2) Sights and control equipment.

(3) Crew positions and duties.

c. *Grenades.*

(1) For dischargers	16 x L8 grenades (8 in dischargers and 8 in boxes on the outside of the turret) ◄
(2) Hand grenades	Stowage for a total of 6 grenades

0224. *Confirm by questions.*

Crew Positions and Seats

0225. *Explain and demonstrate:* The following are the crew positions and duties:

a. *The Commander.* Seated on the left side of the turret, his duties are:

(1) To command the vehicle.

(2) To select targets and fire positions for the vehicle.

(3) To act as fire controller.

(4) To carry out the handling drills for the main armament and the co-axial GPMG.

b. *The Gunner.* Seated on the right side of the turret, his duties are:

(1) To fire the main armament and GPMG as directed by the commander.

(2) To assist the commander in observation and target selection.

c. *The Driver.* Seated on the left side of the hull, his duties are: ◄

(1) To drive the vehicle.

(2) To assist the commander in his selection of vehicle fire positions.

(3) To service and maintain the vehicle.

(4) To act as relief gunner.

0226. ***Seating.*** *Explain and demonstrate:* The operation of the seats.

0227. *Confirm by questions and practice.*

Conclusion

0228. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) Weapons and ammunition.

(2) Sights and control equipment.

(3) Crew positions and duties.

0229. *Reserved.*

a. Invert it.

b. Keep the head down and adopt a stable position. Point the nozzle at an angle of 45° at the seat of the fire.

c. Hit the striker knob against a hard surface.

d. Spray at the seat of the flames — sweeping from side to side.

e. DO NOT TILT FROM THE VERTICAL more than 800 mils or the extinguisher will fail to function.

f. As the rate of discharge cannot be controlled, continue to spray until empty.

g. Obtain a replacement extinguisher as soon as possible.

0245. *Confirm by questions and practice. (Do not allow the striker knob to be operated.)*

Servicing of Portable Extinguishers

0246. *Explain and demonstrate:* To ensure that the extinguishers function correctly, it is important that they are serviced regularly. To do this:

a. Remove the extinguisher from the bracket and inspect for any damage. Check that the writing is legible.

b. Shake the cylinder to determine that liquid is present.

c. Press in the diaphragm at the base. If it does not re-set, the extinguisher must be exchanged.

d. Ensure that the nozzle is not obstructed and that it does not turn completely.

e. Check the bracket for serviceability.

f. Check the securing strap for serviceability.

0247. *Confirm by questions.*

Fixed Fire Extinguisher

0248. *Explain:* In order to combat a fire which might occur within the engine compartment, a fixed fire extinguisher is located on the left side of the vehicle near the driver's hatch. ◄

0249. ***Components.*** *Explain:* The following are the main components of the extinguisher:

a. The cylinder, contains 1.5 kg of BCF liquid.

b. The operating mechanism assembly incorporates:

(1) A hand grip.
(2) A hand lever.
(3) A safety catch.
(4) A red indicator disc.

c. The extinguisher is connected to the vehicle via an external pipe and a union nut.

d. The extinguisher has two discharge nozzles, one opposite the carburettor the other below the induction manifold angled downwards.

Use of the Extinguishers

0250. *Explain:* In the event of a fire occurring within the engine compartment, stop the vehicle and engine, switch off the vehicle master switch and vacate the vehicle:

a. Unlock the safety catch in the direction of the arrow.

b. Ensure that the red disc is dislodged/broken.

c. Squeeze the hand lever for 25 seconds (to fully discharge).

d. Once the fire is out, ventilate the vehicle by opening the hatches and engine decks.

0251. *Confirm by questions.*

Servicing of Fixed Fire Extinguisher

0252. *Explain:* To ensure that the extinguisher functions correctly it is important that it is serviced regularly as follows:

a. Ensure that the safety catch is at SAFE.

b. Ensure that the red indicator is not broken.

c. Check to ensure the cylinder is full.

d. Check the bracket is secured to the vehicle.

e. Check the security of the union nut, and the condition of the pipes and discharge nozzles.

f. The weight of the extinguisher is to be checked annually by REME to ensure that it is 1.5 kg.

0253. *Confirm by questions.*

0254. *Reserved.*

0255. *Reserved.*

Engine

0256. *The instructor should move round the vehicle to check the oil and coolant, then move to the driver's seat, the remainder of the squad on the ground outside and looking in. Explain:* All crew members must be able to both start up and close down the engine in order to check and service equipment in the turret.

0257. ***Starting Up — Cold Engine.*** *Explain and demonstrate:* The following is the sequence of actions:

a. Check that the oil and coolant levels are correct.

b. Check that the handbrake is applied.

c. Check that both steering levers are fully forward.

d. Select the neutral position with the gear change control.

e. Check that the engine speed hand control wing nut is unscrewed, and pull out if necessary the carburettor control (choke) by a third.

f. Put the vehicle master and ignition switches to ON. Check that the oil pressure warning and generator lights on the instrument panel glow, and that the fuel gauge indicates sufficient fuel.

g. Push the starter button and release it as soon as the engine starts. If the engine does not start readily, release the starter button, wait a few seconds, then attempt to start again.

h. Return the starter carburettor control (choke) to the fully in position, as soon as the engine ticks over evenly without the use of the starting device.

j. Accelerate to a speed of 800-1000 rpm and check that the oil pressure and generator lights go out, and a charge is shown on the ammeter.

k. Decelerate and allow the engine speed to drop to idling and check idling speed (500-600 rpm).

WARNING: DO NOT RUN THE ENGINE ABOVE 4700 RPM UNDER ANY CIRCUMSTANCES.

0258. ***Stopping the Engine.*** *Explain:* Allow the engine speed to drop to idling, then turn the ignition switch to OFF. Do not accelerate the engine when switching off.

0259. *Confirm by questions and practice.*

0260. ***Warm Engine.*** *Explain:* Proceed as for a cold engine but do not operate the starter carburettor control device (choke).

0261. ***Engine Cold — Very Cold/Sub Zero Conditions.*** *Explain:*

a. In very cold conditions pull out the carburettor control by two thirds. Return it to one third and then fully in, as soon as the engine ticks over evenly.

b. In sub zero conditions the carburettor control should be fully pulled out. Push it in one third as soon as the engine starts, and fully in as soon as the engine ticks over evenly.

Conclusion

0262. ***End of Lesson Drill.***

- **a.** *Questions from the squad on the entire lesson.*
- **b.** *Confirm by questions and practice.*
- **c.** *Safety precautions normal.*
- **d.** *Pack kit.*
- **e.** *Summary. To include the following:*
  - (1) The need to be alert to the possible causes of fire at all times.
  - (2) The importance of ensuring that the extinguishers are serviced regularly.
  - (3) The importance of following the correct sequence for starting up and closing down.

0263—0265. *Reserved.*

Decision to Evacuate

0276. *Explain and illustrate using the chalkboard evacuation decision chart:* Whilst as a general rule first aid is most efficiently applied outside the vehicle, there are important exceptions. There are also rare occasions when immediate first aid hardly matters at all. The evacuation chart shows the decisions to be made by the senior active crewman prior to the start of any rescue procedure.

0277. *Confirm by questions.*

Rescue of Driver Through the Turret

0278. *Detail the three crewmen to take up position in the vehicle. Explain:* The driver is rescued through the turret if for some reason his own hatch is jammed. The tasks are to be carried out by the gunner and commander, using the following procedure.

0279. ***The Gunner.*** *Explain:* The gunner must:

a. Open his own hatch.

b. Traverse the turret right to approximately 1-2 o'clock until entrance can be gained to the driver's compartment.

c. Depress the gun fully.

0280. ***The Commander.*** *Explain:* Meanwhile the commander is to:

a. Open his own hatch.

b. Fully lower the commander's seat.

c. Disconnect the driver from his communications. The helmet must remain on throughout the rescue.

d. Move the driver over to the right hand side in a supported position.

e. Reach along the driver's left hand side and pull upwards on the transverse lever on the seat mechanism.

f. Push the seat forward as far as possible. Ensure that the driver does not strike the periscope.

g. Maintain support to the driver's head and lower the seat back rest.

h. Place the driver's hands in his lap and lightly bind the wrists together with a face veil or snatch strap.

j. Place the driver's feet on the seat to prevent them catching on the controls.

0281. *Reserved.*

0282. ***The Commander.*** *Explain:* Grasp the driver's coveralls and pull him from the driver's seat into a sitting position on the commander's seat.

0283. ***The Gunner.*** Explain: Lower the track rope end to the commander.

0284. ***The Commander.*** *Explain:* The commander should then:

a. Place the track rope under the driver's arm and across his chest. Secure the rope together behind the driver's shoulder blades with a face veil or snatch strap.

b. Leave the driver in a supported position held by the gunner.

c. Climb out under the breech, via the gunner's hatch and close it.

0285. ***The Commander and Gunner.*** *Explain:* Both should now:

a. Pull the driver up through the commander's hatch into a sitting position, on the commander's hatch cover.

b. Turn and manoeuvre the driver into a sitting position on the rear bin.

0286. ***The Commander.*** *Explain:* Climb down onto the ground ready to receive the driver.

0287. ***The Gunner.*** *Explain:* With the aid of the track rope lower the driver to the ground.

0288. *Confirm by practice using different crews.*

Rescue of the Driver Through the Driver's Hatch

0289. *Detail three crewmen to take up position in the vehicle. Explain:* The tasks are to be carried out by the gunner and commander, using the following procedure.

0290. ***The Gunner.*** *Explain:* The gunner is to traverse the turret to clear the driver's hatch.

0291. ***The Commander and Gunner.*** *Explain:* Both are to:

a. Open own hatches and climb out onto the front of the vehicle.

b. Open the driver's hatch.

c. Disconnect the driver from his communications. The helmet must remain on throughout the rescue operation.

d. Remove the periscope and brow pad (where fitted).

e. Lift the driver's arms out onto the hatch rim.

f. Pull the driver out by lifting under his arms and grasping his coveralls.

g. Lower the driver to the ground over the front of the vehicle.

0292. *Confirm by practice.*

Chapter 3

BASIC SKILLS — 30 mm GUN L21A1 (RARDEN)

LESSON 8. — INTRODUCTION TO THE 30 mm GUN, AMMUNITION AND HANDLING

A. INSTRUCTOR'S NOTES

0301. ***Aim.*** *To teach:*

a. *The characteristics of the 30 mm gun L21A1 (Rarden) and the ammunition.*

b. *The safety precautions and the drill for action, loading, firing, clear gun and make safe.*

0302. ***Timings.*** *Three 40 minute periods.*

0303. ***Method.*** *Basic classroom instructional periods.*

0304. ***Stores.***

30 mm Gun mounted on an instructional stand	*1 per squad*
30 mm drill rounds in clips	*5 x 3 rd clips per squad*
30 mm empty case (drill)	*1 per gun*
Diagram of graticule pattern (No 52 sight)	*1*
Screwdriver electricians	*1 per gun*
Recuperator	*2 per gun*
Ammunition recognition diagram	*1 per squad*
Instructional ammunition	*1 of each type including a drill round*
Additional chair	*1 for use by the gunner during handling*
Table	*1 (ammunition stage)*

0305. ***Preparation.***

a. *Prepare the following Board headings:*

30 mm Introduction and Handling

Aim
Ammunition
Sighting and Laying
Description
Operation

Toxicity Hazard
Safety Precautions
Handling:
Action — Loading — Firing — Clear Guns
Stop — Make Safe — Clear Guns (Make Safe)

For Inspection Clear Guns

b. *Prepare a chalkboard or drop with the Fire Control Order to be used as follows:*

FIRE CONTROL ORDER/RESPONSE

Commander	***Gunner's Response***
Sabot — On	
1000	
APC in Open	*1000 — On*
—	—
Loaded Fire	*Firing Now — Target*
—	*Firing Now — Target*
	Firing Now — Target — 3 Rounds
Target Stop	

c. *Check the operation of the gun. At the end order "Ease springs" to ensure that the feed slide is to the right.*

d. *Number the squad and explain the system of change round.*

e. *Lay out instructional aids/ammunition on the table.*

0306. ***Miscellaneous.***

a. *The demonstrations are to be conducted with the instructor behind the gun. Detail one of the squad as gunner to occupy the gunner's chair. During practice detail a commander and gunner for each of the drills.*

b. *Words of Command. The following words of command are to be used during the practice:*

(1) The instructor will order "Action commander". The member of the squad detailed as commander will reply "Action", and carry out the appropriate drill. The instructor will indicate a target. The commander will then respond with the fire order displayed on the chalkboard orders. The gunner is to respond. The commander then fully loads the gun and reports "Loaded, fire".

(2) The gunner will then report "Firing now target — Firing now target — Firing now target 3 rounds". The instructor will report "Target destroyed". The commander orders "Target — stop". The instructor is to say "Clear guns". The commander is to order "Clear guns" and carry out the commander's appropriate drill.

B. CONDUCT OF THE LESSON

Preliminaries

0307. ***Safety Precautions.*** *30 mm gun to include ease springs. Check ammunition is drill. Explain: Use of the word "Still" as an instructional command.*

0308. ***Revision.*** *Question on amounts of ammunition carried on the relevant vehicle (Fox/Scimitar) and on the position of the main components.*

Introduction

0309. The Ordnance 30mm gun L21A1 (Rarden) is the main armament of the CVR(W) Fox/CVR(T) Scimitar. Rarden is derived from the place of development, the Royal Armament Research and Development Establishment, Enfield. It is a lightweight and highly accurate weapon. It is a single shot weapon, but has the capability to fire short bursts when required. It is designed to fire super velocity armour piercing shot and high explosive ammunition.

Ammunition

0310. *Explain, using ammunition recognition diagrams/instructional ammunition:* The calibre is 30 mm, it is of the fixed type, is quick firing and ignited by a percussion primer. In its 'ready for use' state it is provided in clips of three rounds, each clip having a relevant identification tag. The APSE, HE and Practice rounds have a red tracer element and the APDS a white tracer element. A driving band is located slightly forward of the case.

a. *Armour Piercing Discarding Sabot (APDS). Explain:* The projectile is made up of a sabot protecting a penetrator. The sabot is discarded 20 metres after the projectile leaves the muzzle of the gun. The projectile is painted black denoting the armour defeating capability. Stencilled in black on the case are the letters 'APDS'. The clip is fitted with a plastic marker tag coloured black. For night identification there are no holes in the tag. It is referred to in fire control as "SABOT".

b. *Armour Piercing Secondary Effects (APSE). Explain:* The steel body of the projectile is specially hardened and pointed for armour penetration. The nose of the projectile is made of an aluminium alloy. The projectile is painted black and has a narrow eau-de-nil (light green) band around the middle, which indicates a smoke producing content. Stencilled in black on the case are the letters 'APSE'. The clip is fitted with a plastic marker tag half black and half eau-de-nil (light green). There is one 12 mm hole in each half for identification at night. It is referred to in fire control as "SHOT".

c. *High Explosive (HE). Explain:* The body of the projectile is made of an aluminium alloy and contains a bursting charge and the nose fuze. The projectile is painted yellow which indicates the high explosive hazard. Stencilled in black on the case are the letters 'HE'. For identification the clip is fitted with a plastic marker tag which is all yellow. There is one 12 mm hole centrally for night identification. It is referred to in fire control as "SHELL".

d. *Practice (PRAC). Explain:* The body of the projectile is made of an aluminium alloy and contains a substitute for high explosive. The projectile is painted blue which indicates a training role. Stencilled in black on the case are the letters 'PRAC'. The clip is fitted with a plastic marker tag which is all blue. Three 12 mm holes evenly spaced along its length assist identification at night. It is referred to in fire control as any one of the above types to suit the target being engaged.

e. *Drill. Explain:* The steel body and case are in one piece and coloured silver. Stamped on the base of the cartridge is the word 'DRILL'. A rubber grommit replaces the percussion cap. The rounds are not issued in clips and expended clips from other natures should be used for instruction.

0311. ***Muzzle Velocity (MV) Range and Rate.*** *Explain:* The muzzle velocity of APDS is 1175 metres/second. All other natures are 1080 metres/second. The extreme range is 2000 metres and the cyclic rate of fire is 80 rounds per minute.

0312. *Confirm by questions.*

➤ Sighting and Laying

0313. *Explain:* When a target has been sighted by the commander he gives a fire control order to the gunner. The gunner, using the hand controls, lays the correct part of the graticule pattern onto the target.

Description

0314. ***The Gun.*** *Position the squad equally on either side of the gun. Explain and demonstrate as necessary:* The gun can be divided into three main parts — the top casing, the bottom casing and the barrel (*see* Figs 3, 4 and 5):

a. *The Top Casing.* The top casing houses the feed, firing and cocking mechanism. It is easily detachable from the bottom casing. On the upper surface of the casing is the top cover which is held closed by a catch. To open the top cover push forward on the catch. The feed slide, feed slidecatch and ejector way can be seen. On the rear of the casing is a gun condition selector marked 'S', 'R' and 'A', a gun condition indicator and the loading handle. On the left side is a two pin plug which connects the electrical lead to the solenoid. On the upper surface, above the loading handle, is an anti-toxicity cover which restricts the toxic fumes entering the turret through the loading apertures.

b. *The Bottom Casing.* The bottom casing houses the breech ring assembly and the recoil components. It is shaped at the front to form the barrel sleeve. On the outer side of the sleeve are the trunnion bearings. Bolted to the sleeve is the barrel trough into which are screwed four damping pads. These control barrel vibrations. At the rear of the casing is a cover which is held closed by two rear cover catches. When these catches are lifted it allows the rear cover to open and the top casing to be removed together with the recuperator.

c. *The Barrel.* The barrel is of monobloc construction, threaded at the muzzle end for the attachment of the flash hider.

0315. *Confirm by questions.*

0316. ***Operation.*** The gun is loaded by hand with two clips of three rounds. Initial loading is by operating the loading handle and thereafter by the action of the recoiling components. On firing the gun recoils within its casing approximately 330 mm, under control of the hydraulic buffer. During the final 75 mm of recoil, the breech is opened automatically. The gun is returned to the run out position by the pneumatic recuperator. During runout the empty case is ejected forward through the ejection opening in the mantlet. The breech can also be opened by hand using the loading handle.

0317. *Confirm by questions.*

Toxicity Warning

0318. *Explain:* Commanders must be aware that a toxicity hazard exists when firing the 30 mm gun. The symptoms of a crew member suffering from the effects of toxicity are:

a. Sudden loss of concentration.

b. Dizziness.

c. Headaches.

d. Sickness.

0319. ***Remedy.*** *Explain:* **During training remove the crewman from the vehicle for the rest of the day and encourage him to walk around in the fresh air for 60 minutes. Even if he feels well enough to return to his vehicle after 60 minutes he must not be allowed to do so. If he is still suffering the effects of toxicity poisoning he must seek medical help.**

0320. *Confirm by questions.*

Safety Precautions

0321. *Explain and demonstrate:* On the command "Prove the gun":

a. Select 'Safe' (S) on the gun condition selector. Press in on the top cover catch, open the top cover.

b. Check that the feed slide and ejector way are clear. Check the position of the feed slide:

(1) *Feed Slide to the Right.*

(a) Close the top cover.

(b) Turn the loading handle clockwise until the breech ring has recoiled and starts to run out.

(c) When the gun has fully run out open the top cover, and continue to turn the loading handle clockwise until the rammer claw is in line with the feed slide.

(d) Check that the rammer is clear. Turn the handle until the feed slide moves to the left and engages on the feed slide catch.

(2) *Feed Slide to the Left and Engaged on the Feed Slide Catch.* Continue as at sub-paragraph **d.** below.

c. Rotate the handle a further three turns. Ensure that the loading handle is at 6 o'clock.

d. Close the top cover.

e. Pull up on the rear cover catches to open the rear cover.

f. Check that the bore is clear. *(At this stage on the range the gun would be physically inspected by the Safety Supervisor.)*

g. Once the gun has been checked 'Ease springs' as follows:

(1) Open the top cover.

(2) From the top hold the rammer with the left hand.

(3) Using the right thumb strike the feed slide catch.

(4) Place the right hand into the bottom casing, guide the rammer with the left hand until it can be held by the right hand, close the top cover.

(5) Holding the rammer with the right hand allow it to go forward under control until it is approximately 50 mm from the breech ring, then release it.

(6) Ensure that the rammer is fully forward, the rammer tail is at the 7 o'clock position and that the breech is closed.

(7) Check that the gun condition indicator is at GREEN.

(8) Select 'Repetition' (R) on the gun condition selector. Grip the hammer with the right hand and at the same time press the firing button in the centre of the gun condition selector.

(9) Allow the hammer to swing downwards using the right hand to control its movement to rest.

(10) Close the rear cover and check by pushing down that the rear cover catches are engaged.

(11) Select 'Safe' (S) on the gun condition selector.

0322. ***'Not Green'.*** *Explain:* If the gun condition indicator is not at GREEN, REME assistance is required.

0323. *Now give a complete demonstration of the above drill.*

0324. *Confirm by practice.*

Action — Loading — Firing and Clear Gun

0325. *Position the chair relevant to the gun for the gunner. Detail one of the squad to act as gunner and explain that he will be told when to respond to the fire control order on the chalkboard. Explain and demonstrate:*

a. *Action.* On the command "Action", or on deciding to load, the commander is to issue the word of command "Action" and carry out the following drill:

(1) Select 'Safe' (S) on the gun condition selector.

(2) Press in on the top cover catch, open the top cover.

(3) Ensure that the feed slide and ejector way are clear. *Explain:* If the feed slide is to the right, close the top cover and wind back as taught.

(4) Open the rear cover and check that the bore is clear, report "Bore clear".

(5) Close the rear cover and check that the rear cover catches are down.

(6) Place a clip of three rounds on to the anti-toxicity cover, push the rounds forward into the gun. Press against the base of each round with the thumb to ensure that they are correctly seated. Ensure that the anti-toxicity cover is fully up.

(7) Turn the loading handle anti-clockwise three complete turns. Check that the gun condition indicator is at 'GREEN'.

b. *Fire Order. Explain and demonstrate:*

(1) The commander is to indicate the nature of ammunition required, i.e., Shell, Sabot, etc.

(2) The gunner is to select 'Main' on the gunner's selector switch box.

(3) The commander is to complete the fire order.

(4) The gunner responds with the range and once he has identified the target reports "On".

(5) The commander at the same time loads a further three rounds into the gun, selects 'R' on the gun condition selector and reports "Loaded, Fire".

c. *Firing.* On the report "Loaded, fire" the gunner is to complete the laying and operate the firing switch and report "Firing now — target". Repeat this and then for the third round report "Firing now — target — 3 rounds".

d. *Target Stop.* When the target has been destroyed the commander is to order "Target stop" and select 'Safe' (S) on the gun condition selector. The gunner is to 'de-select'.

e. *Clear Guns.* On the command "Clear guns", or on deciding to unload, the commander is to report "Clear guns" and carry out the following drills:

(1) Select 'Safe' (S) on the gun condition selector.

(2) Open the top cover, remove the empty case from the ejector way. Remove live rounds from the feed slide to the left and return them to the 'ready for use' rack.

(3) Close the top cover.

(4) Turn the loading handle clockwise until the breech ring has recoiled and starts to run out.

(5) When the gun has fully run out open the top cover. Continue to turn the loading handle until the rammer claw is in line with the feed slide.

(6) Remove the live round from the rammer claw and retain it in the left hand.

(7) Continue to turn the handle clockwise until the feed slide moves to the left and engages on the feed slide catch.

(8) Rotate the handle a further three turns and ensure that the handle is at 6 o'clock, return the round to the 'ready for use' rack.

(9) Close the top cover and open the rear cover.

(10) Check that the bore is clear and report "Guns clear".

(11) 'Ease springs' as taught.

0326. *Now give a complete demonstration of the drill using the gunner detailed, as before.*

0327. *Confirm by practice — the last crew to leave the gun loaded.*

Make Safe

0328. *Explain:* Following the order "Target stop" it may be necessary to return the gun to the loaded condition or 'Made Safe'.

0329. *Detail one of the squad to act as gunner. Explain and demonstrate:* The commander is to order "Target stop — Make safe" and carry out the following drill:

a. Select 'Safe' (S) on the gun condition selector.

b. Check that the gunner has also selected 'Off' on the gunner's selector switch.

c. Report "Guns safe".

d. The commander may replenish the gun as required.

0330. ***Subsequent Fire Order.*** *Explain:*

a. To engage further targets from the 'Make Safe', issue a new fire order.

b. If wrong ammunition is loaded into gun the fire order will be "Sabot or Shell loaded fire".

0331. ***'Stop'.*** *Explain:* During an engagement, if the order "Stop" is given the commander is to select 'Safe' (S) on the gun condition selector and await further orders.

0332. *Confirm by practice. Detail a commander and gunner each time and explain the use of the fire control chalkboard. Leave the gun made safe at the end of the practice.*

Clear Guns from Make Safe

0333. *Explain and demonstrate:* On the command "Clear guns" (the gun having been made safe) the commander is to unload as taught.

0334. *Confirm by questions and practice. Detail a commander and gunner. Explain the use of the fire control chalkboard.*

For Inspection — Clear Guns

0335. *Explain and demonstrate:* During range practices, before a crew change or a change round within the crew, and on completion of a practice, the safety supervisor with the vehicle is to ensure that the gun is fully unloaded before the turret is vacated. To do so he has to inspect the gun. He gives the word of command "For inspection, clear guns".

- **a.** The commander is to 'clear guns' as taught but does NOT 'Ease springs'.
- **b.** Open the top and rear covers and report "Guns clear".
- **c.** The supervisor will physically check to ensure that the feed slide and bore are clear. He will then order "Ease springs" or "Do not ease springs, close the top and rear covers".
- **d.** The commander will carry out the drill as ordered.

Conclusion

0336. ***End of Lesson Drill.***

- **a.** *Questions from the squad on the entire lesson.*
- **b.** *Confirm by questions and practice.*
- **c.** *Normal safety precautions, 'Ease springs' and remove the recuperator.*
- **d.** *Pack kit.*
- **e.** *Summary. To include the following:*
  - (1) The importance of the different types of ammunition and their uses.
  - (2) The need for quick, safe drills.
  - (3) The need to note the position of the feed slide in the sequence of the drill.

a. *To Remove.*

(1) Ensure that the gun is clear and fully run out with the breech open, the rammer in line with the feed slide, the feed slide held by its catch and the gun condition selector set to 'Safe'.

(2) Disconnect the electrical lead from the top casing.

(3) Open the rear cover.

(4) *Explain: The assistant is to pull the barrel forward.*

(5) Raise the recuperator safety latch and rotate the recuperator valve cap clear of the retaining groove. Slide the recuperator clear of the gun.

(6) Lift the rear cover catches.

(7) *Explain: The assistant is to push the barrel slowly to the rear.*

(8) As the barrel is moved rearwards slide the top casing rearwards as far as possible. Lift the rear of the top casing and continue to slide it rearwards until the ejector tube is clear of the inner face of the gun mantlet. In the vehicle elevate the gun to assist the slide.

(9) *Explain: The assistant is to stop pushing on the barrel.*

(10) Remove the top casing. Place it on the table.

b. *To Replace* (*see* Fig 4).

(1) Ensure that the cocking slide is fully forward and the breech is open before attempting to replace the top casing.

(2) Align the ejector with the rear cartridge guide. Position the top casing over the bottom casing. Ease the top casing forward with the rear end raised until the guides enter the recesses of the forward guideways of the bottom casing.

(3) *Explain: The assistant is to pull the barrel forward slowly.*

(4) As the barrel moves forward lower the rear end of the top casing into the bottom casing guideways. Continue to push forward on the top casing and pull on the barrel until the rear cover catches engage correctly.

(5) *Explain: The assistant is to pull the barrel forward.*

(6) Raise the recuperator safety latch. Slide the recuperator into the bottom casing, ensure that the lugs of the recuperator valve cap engage into the retaining groove.

(7) Ensure the recuperator safety latch is in the down position.

(8) Connect the electrical lead to the top casing and 'Ease springs'.

0349. *Confirm by questions and practice two at a time, one to act as an assistant — leave gun stripped.*

The Barrel

0350. *Detail one of the squad to act as an assistant. Explain and demonstrate (see* Fig 5):

a. *To Remove.*

(1) Close the breech by pushing forward on the breech block catch.

(2) Disengage the flash hider retaining clip with a screwdriver cabinet. Unscrew and remove the flash hider.

(3) Lift the barrel catch and hold it out of engagement.

(4) *Explain: The assistant is to unscrew the barrel from the breech ring and ease the barrel forward until the breech end is clear of the barrel sleeve.*

(5) Lift the breech end and withdraw the barrel rearwards, ensuring that the threads do not strike the gun mantlet or optical equipment and that no pressure is brought to bear on to the damping pads.

(6) Place the barrel down carefully so that it cannot fall and be damaged. Fit the barrel bearing and breech covers.

(7) Push the breech ring fully forward.

b. *To Replace.*

(1) Position the breech ring assembly in line with the forward cartridge guide.

(2) Slide the muzzle end of the barrel through the damping pads in the barrel trough.

(3) Lower the breech end into the barrel trough, ensure that the threads do not become damaged.

(4) Push the barrel rearwards through the barrel sleeve and into the breech ring, lift the barrel catch.

(5) *Explain: The assistant is to screw the barrel into the breech ring.*

(6) When the barrel is almost flush with the face of the breech ring, release the barrel catch.

(7) *Explain: The assistant is to turn the barrel slowly until resistance is met, then to rotate the barrel anti-clockwise until the barrel catch is heard to click into a serration on the barrel.*

(8) Replace the flash hider and retaining clip.

(9) Using the barrel, push the breech ring assembly to the rear to open the breech.

0351. *Confirm by questions and practice two at a time, one to act as an assistant — leave the gun stripped.*

(9) Align the guides on the unlocking slide bracket with the guideways in the breech ring.

(10) Depress the retaining plunger and slide the bracket forward until it is held by the retaining plunger.

(11) Push the breech block fully to the left to engage the unlocking slide extension with the unlocking slide catch.

(12) Replace the unlocking slide return springs and rods.

0355. *Confirm by questions and practice two at a time, one to act as an assistant — leave the gun stripped.*

Additional Stripping and Assembling

0356. *Squad positioned around the table. Explain:* The removal of the parts covered under the description additional stripping will only be carried out under the following circumstances:

a. Replacement of faulty or damaged parts.

b. During cleaning after firing when it is necessary to remove carbon or dirt which if left on the gun would impair the efficiency of the weapon.

0357. ***The Breech Block Catch.*** *Explain and demonstrate* (*see* Fig 9):

a. *To Remove.*

(1) Insert the blade of a cabinet screwdriver between the breech block catch and its return plunger.

(2) Ease the plunger back taking the pressure off the catch, lift the catch clear of its recess.

(3) Allow the return plunger spring to reassert itself under control.

(4) Remove the plunger and spring.

b. *To Replace.*

(1) Replace the plunger and spring into the recess in the breech ring.

(2) Place the flat of a screwdriver blade against the head of the plunger.

(3) Ease the plunger back into its recess.

(4) Replace the breech block catch, with the raised portion to the right, ensure that it is correctly seated.

(5) Allow the plunger spring to reassert itself, remove the screwdriver.

0358. ***The Top Cover and Ejection Tube Housing.*** *Detail one of the squad to act as an assistant. Explain and demonstrate:*

a. *To Remove.*

(1) Open the top cover, ensure that the feed slide is positioned to the left.

(2) *Explain: The assistant is to hold the cover in the open position.*

(3) Press inwards on the two lugs of the spring loaded pivot pins, located on the underside of the top cover.

(4) *Explain: The assistant is to lift the cover clear.*

(5) Release the pivot pins.

(6) Using two small drifts or punches, press downwards on the ejection tube retaining plungers. The plungers are located in recesses on either side of the top casing.

(7) *Explain: The assistant is to push the ejection tube housing forward until the guides are clear of the guideways, then lift the housing clear of the top casing.*

b. *To Replace.*

(1) Position the ejection tube housing over the top casing so that the bottom rear corners of the guides are resting on the retaining plungers.

(2) Press the housing downwards to depress the plungers, slide the housing rearwards until the plungers reassert and lock the housing in position.

(3) *Explain: The assistant is to position the top cover over the pivot points in the ejection tube housing.*

(4) Press inwards on the lugs of the spring loaded pivot pins. Lower the top cover into position, release the pivot pins.

(5) Open and close the cover to ensure that it is operating correctly.

0359. *Confirm by practice two at a time, one to act as an assistant — leave the gun stripped.*

Part Names

0360. *By question and answer identify the component part names handled in the lesson, the body first followed by the components on the table. Finally assemble the gun.*

0361. *The squad should now be practised in stripping and assembling the 30 mm gun on the vehicle.*

Conclusion

0362. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The importance of stripping in the correct sequence.

(2) Correct application of the rules of stripping and assembling.

(3) Use the tools correctly and never use undue force.

0363 — 0366. *Reserved.*

LESSON 10. — MISFIRE DRILL

A. INSTRUCTOR'S NOTES

0367. **Aim.** *To teach the correct actions to be carried out on the 30 mm Rarden gun in order to remedy a misfire.*

0368. **Timings.** *Four 40 minute periods.*

0369. **Method.** *Basic classroom instructional periods.*

0370. **Stores.**

30 mm Gun mounted on an instructional stand	*1 per squad (crew)*
30 mm Drill rounds and clips	*5 x 3 round clips per gun*
30 mm empty case (drill)	*1 per gun*
Screwdriver electricians	*1 per gun*
Recuperator	*2 per gun*
Cleaning rod and handle	*1 per gun*
Breech cleaning tool	*1 per gun*

0371. **Preparation.**

a. *Prepare the following Board headings:*

30 mm Misfire Drills

Aim
Causes
Indication GREEN

Incorrect Drill/Circuit Failure
Misfired Round/Firing Gear Failure

Indication NOT GREEN

Gap in Feed/Ammunition Expended
Overgauged or Damaged Round
Fouling
Jammed Feed or Feed Slide

Additional Faults

Rammer Catch Failure
Rack Catch Failure
Recuperator Failure
Broken Components
Rammer Claw Failure

b. *Fit the recuperator and check that the gun functions correctly.*

c. *Number the squad and explain the system of change round.*

0372. ***Miscellaneous.***

a. *Classroom Drill. During confirmation of the misfire drill when the soldier is called out he is to stand behind the gun facing AWAY from it. On the command "Mount" he is to turn and take up a working position.*

b. *Words of Command. The following are to be used:*

(1) "Firing now — misfire".

(2) When the gun fails to fire after the initial action indicate this by ordering "Gun still fails to fire".

c. *Safety. Whenever a misfire occurs the drill includes a check of the colour coding of the gun condition indicator. The colour registered by the pointer is either GREEN or NOT GREEN.*

(1) GREEN. This indicates that a round is chambered and the breech is fully closed. Once errors in crew drills or an electrical failure in the firing circuit have been eliminated, a WAIT PERIOD of 30 SECONDS (10 minutes for APDS) must be observed before any further action is carried out on the gun. This wait period is necessary due to the possibility of a 'hang fire'.

(2) NOT GREEN. This indicates that the breech is not fully closed and that the gun is safe to handle in order to determine the fault by completing the misfire drill.

d. *Initial squad formation seated, the instructor on the far side of the 30 mm stand. For the demonstration of misfire drills the instructor stands behind the gun and the squad on either side but re-seated for confirmation.*

B. CONDUCT OF THE LESSON

Preliminaries

0373. ***Safety Precautions.*** *Normal.*

0374. ***Revision.*** *Question on types of ammunition. Then two-man teams revise handling drills, i.e., prove the gun; action fire order, clear guns, make safe. Having revised the last man the instructor orders "Firing now" — "Misfire" — "Sit down ", or the last crew out to complete an engagement is ordered to "Make safe".*

Introduction

0375. *Explain:* If the gun fails to fire it is important that the crew knows how to remedy the misfire with the minimum loss of time.

0376–0377. *Reserved.* ◄

Causes of Misfire

0378. *Explain:* Misfires are caused by one or more of the following:

a. *Incorrect Drill.* By either the gunner or the commander failing to carry out the drills properly.

b. *Failing of Firing Circuit.* Either an electrical or mechanical fault within the gun.

c. *Faulty Ammunition.* A misfired or damaged round.

d. *Obstruction or Fault in the Gun.* An obstruction could be caused by a broken part obstructing the feed of rounds into the chamber.

e. *Ammunition Expended.*

0379. *Confirm by questions.*

Misfire Drill — Indication GREEN

0380. *Explain and demonstrate the classroom drill during confirmation of Misfire Drill.*

0381. ***Incorrect Drill.*** *Explain and demonstrate:*

a. The gunner reports "Misfire" and checks the position of the gunner selector switch. If he has not selected 'Main' he will report "Switches" and switch to main.

b. The commander will carry out the following drill:

(1) Check that the gun condition indicator is at GREEN.

(2) Check that the anti-toxicity cover is fully up and that the gun condition selector is set to 'R' and report "Loaded".

c. The gunner relays and orders "Fire".

d. The commander reports "Firing now" and operates the firing button. If the gun fires all right the commander orders "Go on".

e. The gunner will continue the engagement.

0382. *Give a complete demonstration of the drill.*

0383. *Confirm by practice. Use the words of command as in paragraph 0372.**b.***

0384. ***Circuit Failure.*** *Explain and demonstrate:*

a. If during an engagement the gun fails to fire, the gunner reports "Misfire".

b. The commander is to carry out the following drill:

(1) Check that the gun condition indicator is at GREEN.

(2) Check that the anti-toxicity cover is up, and the gun condition selector is set at 'R' and report "Loaded".

c. The gunner relays and orders "Fire".

d. The commander reports "Firing now" and operates the firing button. If the gun fires all right he says nothing.

e. The gunner then orders "Circuit failure".

f. The commander continues to fire using the firing button, until the fault can be rectified during a lull in firing.

0385. *Give a complete demonstration of the drill.*

0386. *Confirm by practice. On last man out, when the commander attempts to fire, order "The gun still fails to fire" — "Sit down".*

0387. ***Misfired Round/Firing Gear Failure.*** *Explain and demonstrate:*

a. The commander, having carried out the above drill and the gun still fails to fire, orders "Misfire Green — wait 30 seconds" (APDS — 10 minutes).

b. After the 30 seconds/10 minutes — select 'Safe', open the top cover, remove the empty case and clear the feed slide. Close the top cover and open the rear cover to determine whether any ammunition or broken components have fallen into the gun. If an obstruction is found it must be removed prior to winding back. Close the rear cover, fully clear the gun, retain the live round removed from the rammer. Close the top cover.

c. Leave rear cover open, the round is to be inspected to determine whether the percussion cap has been struck or not.

(1) *Cap Struck.* (During training deal with in accordance with Range Standing Orders and Infantry Training Volume IV, Ranges, Pamphlet No. 21, Range Conduct and Safety Rules (Army Code No. 71080).)

(2) *Cap Not Struck.* Test the firing gears (report to REME if necessary).

d. Once the fault has been rectified, the commander is to close the rear cover, fully load, check the gun condition indicator is at GREEN, select 'R' and report "Loaded, Fire". The gunner relays, reports "Firing now" and continues the engagement.

0388. ***Further Action.*** *Explain:*

a. If the gun still fails to fire the misfire period of 30 seconds/10 minutes must be observed for this successive misfire, and the gun examined by REME.

b. During the 30 second/10 minute waiting period a round may be fired. In this event the gun is not to be touched, ATO and REME are to be informed.

0389. *Give a complete demonstration of the drill.*

0390. *Confirm by practice. Use the commands and responses "Cap struck", "Not struck" — "Fault in firing gear" — "Rectified". Last man out order "For inspection clear guns".*

Misfire Indication NOT GREEN

0391. ***Gap in Feed/Ammunition Expended.*** *Explain and demonstrate:*

a. If, during firing the gun fails to fire, the gunner will report "Misfire".

b. The commander is to carry out the following drill:

(1) Check the gun condition indicator is not at green.

(2) Report "Not green", select 'S' on the gun condition selector and open the top cover.

(3) *Explain:* It was a failure to fully load, hence the gap in the feed.

(4) Remove the empty case from the ejector way and examine the feed slide for ammunition present.

(5) *Explain:* Whether three rounds are present or the feed slide is clear, the commander is to close the top cover.

(6) Open the rear cover and check for obstructions in the bottom casing. Close the rear cover, fully load the gun and check that the gun condition indicator is at GREEN.

(7) Select 'R' and report "Loaded, Fire".

c. The gunner is to relay, report "Firing now" and continue the engagement.

0392. *Give a complete demonstration of the drill.*

0393. *Confirm by practice. When the last man has completed the drill, order "For inspection clear guns".*

0394. *To prepare for the next cause of misfire, ensure that the feed slide is to the left, open the rear cover, operate the feed slide catch and guide the rammer down to the 6 o'clock position and pull it to the rear until it is held by its catch. Pull the rammer claw lugs rearwards, place a drill round in the rammer claw, release the rammer catch and ease the rammer forward. Do not close the breech. Place any number of rounds on the feed slide and an empty case on the ejector way, then select 'R'.*

0395. ***Overgauged/Damaged Round.*** *Explain and demonstrate:*

a. The gunner is to report "Misfire".

b. The commander is to carry out the following drill:

(1) Check the gun condition indicator — NOT GREEN.

(2) Report "Not green", select 'Safe' on the gun condition selector, open the top cover and clear the ejector way and feed slide.

(3) Open the rear cover and check inside for any obstruction. Clear if necessary. Close the rear cover and clear the gun fully.

(4) Examine the round that has been removed from the breech (*Explain:* overgauged/damaged rounds).

(5) Fully load the gun, check that the gun condition indicator is at GREEN.

(6) Select 'R' and report "Loaded, Fire".

c. The gunner is to relay, report "Firing now" and continue the engagement.

0396. *Explain and demonstrate:* If, on carrying out the above drill, no damaged/overgauged round is found then fouling is to be suspected and the chamber cleaned as follows:

a. Ensure that the breech is open.

b. Attach the breech cleaning tool to a section of the cleaning rod and fit the handle.

c. Insert into the chamber and clean using a twisting action.

d. Having removed the fouling, remove the tool, then the commander and gunner are to complete the remainder of the drill as in paragraph 0395.**b.**(5) to **c.** inclusive.

0397. *Confirm by practice, the last man to 'Clear guns' but not to 'Ease springs'.*

0398. ***Jammed Feed or Feed Slide.*** *Explain and demonstrate:*

a. The gunner reports "Misfire".

b. The commander is to carry out the following drill:

(1) Check the gun condition indicator — NOT GREEN.

(2) Report "Not green", select safe on the gun condition selector and attempt to open the top cover.

(3) If the cover fails to open, maintain pressure on the top cover catch and rotate the loading handle clockwise until it will open, a sharp tap will usually free the top cover.

(4) Stop rotating and clear the ejector way and feed slide. Open the rear cover, check for and clear any obstruction in the body.

(5) Ensure that the gun is fully cleared, fully load, and check that the gun condition indicator is at GREEN.

(6) Select 'R' and report "Loaded, Fire".

c. The gunner is to relay, report "Firing now" and continue the engagement.

0399. *Explain:* If, during training, the cover will not open, REME must be informed.

03100. *Confirm by questions.*

Additional Faults

03101. *Explain:* REME must be informed if the gun cannot be cleared because of the following faults:

- **a.** A rammer catch failure.
- **b.** A rack catch failure.
- **c.** A recuperator failure.
- **d.** Broken components.
- **e.** Rammer claw failure.

03102. *Confirm by questions.*

Conclusion

03103. ***End of Lesson Drill.***

- **a.** *Questions from the squad on the entire lesson.*
- **b.** *Confirm by questions and practice.*
- **c.** *Normal safety precautions.*
- **d.** *Pack kit.*
- **e.** *Summary. To include the following:*
  - (1) The importance of checking the gun condition indicator.
  - (2) Observing the 'wait 30 seconds and 10 minutes' rules.

LESSON 12. — THE 30 mm GUN RECOIL SYSTEM, COMPONENTS AND SERVICING

A. INSTRUCTOR'S NOTES

03120. ***Aim.*** *To teach the recoil system and its servicing.*

03121. ***Timings.*** *Three 40 minute periods.*

03122. ***Method.*** *Basic classroom and vehicle/CIM instructional periods.*

03123. ***Stores.***

30 mm gun mounted on an instructional stand	*1 per squad*
CVR(W)/CVR(T) or CIM	*1 per squad*
Diagrams/models of recoil system	*As required*
Machine gun cleaning rod	*1 per gun*
30 mm cleaning rod handle	*1 per gun*
Hold back tool 30 mm	*1 per gun*
Operating tool 30 mm	*1 per gun*
Screwdriver cabinet	*1 per squad*
Oil OM 18	*As required*
Cloth/rags	*As required*
Recuperator	*2 per gun*
Table	*1 per squad*
P & O injector or syringe	*1 per gun*
Hook breech ring assemble	*1 per gun*

03124. ***Preparation.***

a. *Prepare the following Board headings:*

Recoil System Components and Servicing

Aim
Buffer/Replenisher Components
Recuperator Components
Operation
Servicing
Faults

b. *Number the squad and explain the system of change round.*

03125. ***Miscellaneous.***

- **a.** *Remove the top casing and recuperator.*
- **b.** *Drain off a small quantity of oil OM 18.*
- **c.** *Position the squad in demonstration formation around the gun stand.*

B. CONDUCT OF THE LESSON

Preliminaries

03126. ***Safety Precautions.*** *Normal.*

03127. ***Revision.*** *Identify the main components to be dealt with in the lesson.*

Introduction

03128. *Explain:* It is important that the gun operates correctly at all times. A recoil system is fitted and its purpose is to:

- **a.** Hold the gun in the firing position at all angles of elevation.
- **b.** Absorb the recoil energy.
- **c.** Achieve a fixed length of recoil at all angles of elevation.
- **d.** Return the gun under control to the firing position.

03129. *Confirm by questions.*

The Buffer

03130. *Using aids, diagrams and the gun, explain and illustrate* (*see* Fig 14): The buffer and replenisher are housed within the bottom casing, fixed in position within the barrel sleeve and the breech ring extension. The components are:

- **a.** Replenisher.
- **b.** Filler plug with a snifter air release valve.
- **c.** Strainer (housed under filler plug).
- **d.** Tell tale rod.
- **e.** Annular grooves.
- **f.** Tapping for the MG cleaning rod.
- **g.** Buffer cylinder.
- **h.** Piston.
- **i.** Mounting screw.

j. The whole system houses approximately one pint of oil OM 18.

k. Buffer pad.

l. Bearing plug in rear cover.

03131. *Confirm by questions.*

The Replenisher

03132. *Explain and demonstrate:*

a. *Fixed Components.*

(1) The cylinder has a filler plug which incorporates a snifter air release valve.

(2) The strainer, spring and two holes. The holes allow the oil to flow from the replenisher to the gallery.

(3) The guide, with a series of washers/sealing rings.

b. *Movable Components.* A spring operated piston, incorporating a tell tale rod which has three angular grooves.

03133. *Confirm by questions.*

The Recuperator

03134. *Explain and demonstrate:*

a. The pneumatic recuperator is housed in the bracket on the right side of the breech ring. It consists of a cylinder and piston.

b. The cylinder has a screw fitted which is an oil filler plug for oil OM 18 contained in the reservoir, a felt washer and oil sealing rings.

c. A piston, incorporating a schrader valve, is for charging purposes. This is a REME task (the air pressure is between 480 and 500 lb/in^2).

d. The schrader valve has a domed cap which fits over to protect it. It also forms a point of contact with the bearing plug fitted into the rear cover.

e. The cap has two projections, which fit into recesses in the bottom casing.

03135. *Confirm by questions.*

Operation

03136. *Explain and demonstrate:*

a. *Buffer and Replenisher.* The buffer with the oil within absorbs recoil energy. It also controls the speed and length of recoil.

b. *Recuperator.* The recuperator returns the gun to the correct firing position in all angles of elevation. It also holds the gun in the correct firing position at all angles of elevation.

03137. *Confirm by questions.*

03138–03142. *Reserved.*

Servicing and Faults

03143. *Explain:* The charging and gauging of the air pressure of the recuperator is carried out by REME. A crewman check should be carried out whenever the operation of the recuperator is suspect and during the servicing of the recoil system.

03144. ***Recuperator Check.*** *Explain and demonstrate:* To check the recuperator the procedure is as follows:

a. Level the gun.

b. Prove the gun and ensure that the mechanism functions correctly.

c. Elevate the gun until maximum elevation is reached.

d. Carry out the procedure for proving the gun again but on this occasion, when the firing button is pressed, note the action of the hammer.

(1) If the hammer is released, the recuperator is charged sufficiently to operate the gun correctly.

(2) If the hammer is not released, the recuperator is failing to hold the gun in the fully run out position and REME assistance is required.

03145. *Confirm by questions and practice.*

03146. ***Recuperator Oil Reservoir.*** *Explain and demonstrate* (*see* Fig 15): To top up the oil reservoir:

a. Prove the gun.

b. Remove the recuperator from the gun.

c. Unscrew the oil reservoir filler plug, top up the reservoir with oil OM 18. Replace the filler plug.

d. Replace the recuperator into the gun.

03147. *Confirm by questions and practice.*

03148. ***The Buffer System Check.*** *Explain:* The check is to be carried out when the gun is cold.

03149. *Explain and demonstrate:* Carry out the following procedure:

a. Complete the check of the recuperator.

b. Level the gun, open the rear cover.

c. Check the position of the annular grooves on the tell tale rod:

(1) If no annular grooves are exposed, the buffer system requires topping up with oil OM 18.

(2) If one and a half to two annular grooves are exposed, attempt to push the tell tale rod forward. ◄

(3) If the rod moves forward, air is present and must be removed by topping up the system.

(4) If the rod does not move, the buffer system does not require servicing. ◄

03150. *Confirm by questions.*

03151. ***Topping Up the Buffer System.*** *Explain and demonstrate:* Only oil OM 18 is to be used when topping up the system. The use of other oils can reduce the efficiency and serviceability of the buffer. Care must be taken to prevent the ingress of dirt or grit when topping up the system. The procedure for topping up the buffer system is to be carried out as follows:

a. Remove the top casing.

b. Level the gun and replace the recuperator.

c. Connect the operating tool to the tell tale rod, pull the tell tale rod to the rear until three annular grooves are exposed, insert the holdback tool in the groove nearest to the replenisher. Angle the holdback tool to the left and this will ensure that it is not displaced during the topping up procedure.

d. Release pressure on the operating tool and allow the holdback tool to take the tension off the replenisher spring.

e. Insert the pintles of the handle of the 30 mm cleaning rod into the holes of the filler plug and unscrew the plug.

f. Top up with oil OM 18 until the oil level reaches the bottom thread of the filler aperture.

g. Replace the filler plug and remove the holdback tool.

h. Elevate and depress the gun several times to move any air into the replenisher.

i. Position the gun slightly above the horizontal.

j. Depress the snifter valve, at intervals, to bleed the system until between one and a half to two annular grooves are exposed on the tell tale rod. ◄

k. Using the operating tool or GPMG cleaning rod, push forward on the tell tale rod.

(1) If the tell tale rod does not move forward, air is not present in the system.

(2) If the tell tale rod moves forward, air is present and the system must be bled again and topped up if necessary.

l. With clean cloth, wipe the system clean and clear any oil from the bottom casing.

m. Remove the operating tool or GPMG cleaning rod and the recuperator.

n. Check the system for leaks and security.

o. Reassemble the gun and test the operation.

03152. *Confirm by questions and practice.*

Conclusion

03153. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The purpose of the recoil system.

(2) Stress the need for correct servicing.

(3) Test the buffer only with a cold gun.

B. CONDUCT OF THE LESSON

Preliminaries

0431. ***Safety Precautions.*** *Normal.*

0432. ***Revision.*** *Introduction to the L37 GPMG.*

Introduction

0433. *Explain:* It is essential that the soldier is capable of maintaining the co-axially mounted machine gun in a state of readiness under battle conditions. A knowledge of the actions he is to carry out will achieve this objective.

Rates of Fire

0434. *Explain:* The gun is normally fired in bursts. The normal rate of fire is 100 rounds per minute. The rapid rate is 200 rounds per minute. The maximum length of burst of 8 to 10 tracer and the rates of fire are never to be exceeded.

Action — Loading — Firing and Clear Guns

0435. *Detail one of the squad to act as gunner and explain that he will be told when to respond to the Fire Control Order on the chalkboard. Explain and demonstrate:*

a. *Action.* On the command "Action", or on deciding to load, the commander is to:

(1) Order "Action".

(2) Open the top cover with the right hand. Position the belt on the feed tray with the links uppermost and the first round against the cartridge stop.

(3) Hold the belt in position with the left hand and close the top cover, check to ensure that it is closed.

b. *Fire Control Order.* On receipt of a fire control order the actions of the commander/gunner are as follows:

(1) The commander orders "Co-Ax" and cocks the gun, pulling the remote cocking handle fully to the rear and returning it fully forward.

(2) The gunner is to select 'Co-Ax' on the gunner's selector switch box.

(3) The commander completes the fire order.

(4) The gunner is to identify the target, respond with the range followed by "On".

(5) The commander then reports "Loaded, Fire".

c. *Firing.* On the report "Loaded, Fire", the gunner is to operate the firing switch and report "Firing Now — Target". He will continue to fire. (*The instructor is to operate the trigger on "Now" and re-cock the gun.*)

d. *Target Stop.* When the target has been destroyed the commander is to order "Target stop". The gunner is to 'de-select'.

e. *Unload.* On the command "Clear guns", or on deciding to unload, the commander is to:

(1) Order "Clear guns".

(2) Cock the gun and return the cocking handle to the forward position.

(3) Control the belt with the left hand, open the top cover with the right hand. Remove and restow the belt.

(4) Clear the feed tray to the right and close the top cover as quickly as possible.

(5) Operate the trigger bar extension and report "Guns clear".

0436. *Give a complete demonstration of the above drill using the gunner as before.*

0437. *Confirm by questions and practice.*

Stop, Make Safe

0438. *Explain:*

a. *"Stop".* During an engagement if the order "Stop" is given the commander is to cock the gun and put the safety catch to 'Safe' and await further orders.

b. *"Make Safe".* It is often necessary, after cocking the gun, to return it to a state in which it is loaded but safe. The commander is to:

(1) Unload.

(2) Reload.

➤ (3) Check that the gunner has de-selected on the gunner's selector switch box.

(4) Report "Guns safe".

0439. *Confirm by practice and leave the gun 'Made Safe'.*

For Inspection — Clear Guns

0440. *Explain and demonstrate:* During range practices, before a crew change or change round within the crew, and on completion of a practice, the safety supervisor with the vehicle is to ensure that the gun is fully unloaded before the turret is vacated. To do so he has to inspect the gun. He gives the word of command "For inspection, clear guns".

a. The commander is to order "For inspection, clear guns" and carry out the following actions:

0512. ***Servicing.*** *Explain:* The crew are required to check the mounting bolts, keep the equipment clean and grease the equilibrator with XG 279. All other servicing and tests are completed by REME.

0513. *Confirm by questions and practical handling.*

The Traversing Gear

0514. ***Components.*** *Explain and demonstrate:* The hand traverse gear consists of a traversing handle and a gearbox. Consistent with the components is a turret lock.

a. *The Traversing Handle.* The handle is conveniently situated to the right of the gunner's position and is connected to the driving shaft incorporated in the traverse gearbox. The traversing gear incorporates a two speed mechanism, giving a slow (fine) and fast (coarse) rate of traverse. The speed of traverse can be selected by pulling down on the traversing handle for slow traverse and pushing up for fast traverse. The turret is moved to the right by rotating the traversing handle clockwise and to the left, anti-clockwise.

b. *The Traverse Gearbox.* The gearbox is bolted to the turret sill to the right front of the gunner's position. It conveys the drive from the traversing handle through a system of gearing to a pinion engaged with the turret ring. The gearbox is protected from possible damage, due to the gun or turret striking some solid obstruction, by a multi-plate friction clutch built into the gearbox. A traverse indicator is mounted to the top of the gearbox.

c. *The Turret Lock — CVR(W) Only.* The lock is bolted to the turret sill. It consists of a plate which has three teeth on the underside, these teeth engage into the teeth of the turret ring to lock the turret. The turret lock must be disengaged by lifting up on the plate before attempting to traverse the turret.

0515. ***Servicing.*** *Explain:* The crew are required to check the mounting bolts, keep the equipment clean, lubricate the traversing handle with oil OMD 80. Servicing of the gearbox is carried out by REME.

a. *To Lubricate the Turret Roballo Ring.* Locate the two Allen screws situated on the turret ring to the right and below the traverse gear box.

b. *Roballo Race.*

(1) Remove the lower Allen screw.

(2) Insert the nozzle of aerosol can LVG/MTI 9150-99-224-5987 lubricant solid film.

(3) Steadily traverse the turret through 6400 mils while operating the aerosol spray.

(4) Once 6400 mils has been completed, remove nozzle and replace Allen screw.

c. *Roballo Seal.*

(1) Remove the upper Allen screw.

(2) Insert grease gun nozzle (XG 279).

(3) Steadily traverse turret through 6400 mils injecting a shot of grease at eight equidistant points.

(4) Once 6400 mils has been completed remove grease gun nozzle and replace Allen screw.

0516. *Confirm by questions and practical handling.*

The Traverse Indicator No 5 Mk 1 — CVR(W) Only

0517. ***Description.*** *Explain and demonstrate* (*see* Fig 21):

a. The instrument, which is mechanically driven, is mounted on top of the traverse gearbox on the Fox vehicle only. The dial is marked with scales which are used in conjunction with the rotating pointer.

b. A pointer zeroing knob is provided in the centre of the dial.

c. The scale is marked in five mil intervals and numbered every 100 mils from 0–500, in red for left rotation, and green for right rotation.

0518. ***Use.*** *Explain:*

a. The instrument is permanently in mesh with the traversing gears and the pointer will move when the turret is traversed.

b. To zero the pointer turn the zeroing knob as required, to bring the pointer into line with the zero mark.

0519. ***Servicing.*** *Explain:* Check that the instrument is secure and keep it clean by wiping with rags.

0520. *Confirm by questions.*

Conclusion

0521. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The importance of completing the lay in elevation.

(2) Ensure that the turret lock is disengaged before attempting to traverse the turret.

LESSON 19. — THE MULTI BARREL SMOKE GRENADE DISCHARGERS

A. INSTRUCTOR'S NOTES

0522. ***Aim.***

a. *To teach the description of the grenade dischargers and grenades on CVR(W) and CVR(T).*

b. *To teach the loading, unloading, operation, testing and servicing of the dischargers.*

0523. ***Timings.*** *Two 40 minute periods.*

0524. ***Method.*** *Basic instructional periods on CVR(W) or CVR(T).*

0525. ***Stores.***

CVR(W) or CVR(T)	*1 per squad*
Instructional Ammunition L8 smoke grenades, drill	*1 of each per squad*
Drill Grenades L1A1	*1 per vehicle*
Stiff piece of wire (200 mm long)	*1*
Clean cloth	*As required*
Oil can filled with OMD 80	*1 per vehicle*
24 volt bulb	*1 per vehicle*
Screwdriver cabinet	*1 per vehicle*
Table	*1 per squad*
Rubber caps	*8 per vehicle*

0526. ***Preparation.***

a. *Prepare the following Board headings:*

Multi Barrel Smoke Grenade Dischargers

Aim
Grenades — Description
Dischargers — Description
Operation
Testing
Loading and Unloading
Firing and Misfire
Servicing
Safety and First Aid

b. *Prepare a chalkboard or drop showing ejection details (see* Fig 22*).*

c. *Ensure that all stores are laid in a convenient place.*

d. *Number the squad and explain the system of change round.*

0527. ***Miscellaneous.***

a. *Ensure that each discharger is functioning correctly.*

b. *Group the squad around the table then move to the vehicle for the description of dischargers and subsequent drills.*

B. CONDUCT OF THE LESSON

Preliminaries

0528. ***Safety Precautions.*** *Ensure that all grenades are Drill.*

0529. ***Revision.*** *Nil.*

Introduction

0530. *Explain:* The smoke producing capability, provided by the grenade dischargers, is used to produce an immediate close range smoke screen, should the vehicle be involved in a surprise encounter with the enemy. The smoke is effective for only a short duration.

Description of the Grenades

0531. ***L1A1 Grenade.*** *Explain:*

a. The grenade is completely inert.

b. The body of the grenade consists of a steel cylinder with flanged edges.

c. The colour is deep saxe blue.

d. The base is fitted with a female electrical jack type connection.

➤ 0532–0533. *Reserved.*

0534. ***L8 (Phosphorus) Grenade.*** *Explain:*

a. The grenade is rubber in construction with a metal base painted eau-de-nil.

b. Around the top is a mid-brown hazard band (low explosive).

Description of the Dischargers

0535. *Explain and demonstrate:*

a. Each discharger consists of a base plate and four grenade cups. On some vehicles the right side has banks of two cups.

b. The cups are fitted internally with a male adaptor which forms part of the electrical jack type connection.

c. A drain hole is at the lowest point in each cup.

d. The cups are at all times to be fitted with the issued rubber caps to prevent dislodgement of the grenade and ingress of dirt, dust and water.

e. The dischargers are connected electrically to the firing button switch box usually situated to the left side of the turret convenient to the commander's left hand. The position may vary from vehicle to vehicle.

f. The electrical circuit is protected by fuze 5 on the turret control and power supply box.

0536. *Confirm by questions.*

0537. *Reserved.* ◄

Operation

0538. ***L8 Grenade.*** *Explain using diagram (see* Fig 22): ◄

a. On firing, the propellant charge ejects the grenades and ignites the delay charge.

b. After a delay of one second the grenades burst 30 metres from the vehicle at a height of 6-8 metres. They produce an immediate cloud of white smoke of approximately 60 seconds' duration.

0539. *Confirm by questions.*

Testing the Discharger

0540. *Explain and demonstrate:* The following actions must be carried out before servicing, loading or firing:

a. Turn on the master switch.

b. Earth the bulb on the discharger cup and touch the centre contact of the bulb with a screwdriver, so that when the appropriate firing button is pressed, the bulb should illuminate.

c. Release the firing button and the light should go out.

d. If the bulb does not illuminate change fuze 5.

e. If the bulb still does not illuminate report the fault to REME.

0541. *Confirm by questions and practice.*

Loading and Unloading the Discharger

0542. ***Radio Frequency (RF) Hazard.*** *Explain:* An RF hazard exists. Before loading or unloading the following precautions are to be taken:

a. Turn the master switch to 'Off'.

b. If this is not tactically feasible ensure that all radios within a 2 metre radius do NOT transmit.

0543. ***Loading.*** *Explain and demonstrate:*

a. Remove the rubber caps from the cups.

b. Ensure that the electrical connection is clean. Insert the grenades one at a time, working from the front inside to the rear outside cup.

c. Ensure that a good contact is made by pushing firmly down on the grenade.

d. Keep the hands clear of the loaded cup.

e. Replace the rubber cap.

0544. ***Unloading.*** *Explain and demonstrate:*

a. Remove the rubber caps and the grenades one at a time, working from the rear outside, to the front inside cup.

b. Keep hands clear of the loaded cups.

c. Replace all rubber caps.

0545. *Confirm by questions and practice leaving loaded.*

Firing and Misfire

0546. ***Firing.*** *Explain:* Set the master switch to the 'On' position and press either or both firing buttons as required.

0547. ***Misfire.*** *Explain and demonstrate:*

a. Should the dischargers fail to operate when the firing button is pressed, carry out the following actions:

(1) If only one button fails press the other button.

(2) If both have failed ensure that the master switch is 'On', and operate the button(s) again.

b. Should the discharger still fail to fire:

(1) Change fuze 5 on the turret control and power supply box.

(2) Attempt to fire again, if the discharger still fails to fire.

(3) Wait 5 minutes. Unload and test the circuit.

(4) Correct any fault found (with REME assistance if necessary).

(5) Load and fire.

0548. *Confirm by practice.*

0549. ***Further Action.*** *Explain:*

a. If the system is still ineffective or a major fault is suspected or discovered, ensure that the dischargers are unloaded.

b. Any unloaded grenade is to be treated as a misfire.

c. Under active service conditions the time limit on these drills may be disregarded at the discretion of the vehicle commander.

0550. ***Blinds and Misfires.*** *Explain:* Any grenade that fails to eject from the discharger cup and any that fail to ignite are to be dealt with in accordance with the detail given in Infantry Training Volume IV, Ranges, Pamphlet No 21, Range Conduct and Safety Rules (All Arms) 1978 (Army Code No 71080).

0551. *Confirm by questions.*

Servicing

0552. *Explain and demonstrate:*

a. Using the stiff wire, clear the drain hole in each cup.

b. Dry and lightly oil the cups.

c. Check all electrical connections.

d. Check or replace all rubber caps.

0553. *Confirm by questions.*

Safety

0554. *Explain:* The phosphorus content of the L8 grenade produces a risk factor to friendly troops in the area of firing, therefore the following rules must be adhered to:

a. Copious amounts of water must be available.

b. Crews must be conversant with the treatment of phosphorus burns.

c. On demonstrations, firing must be down wind.

d. In the event of a misfire the 5 minute wait MUST be observed.

e. No waiting crews or equipment are to be within 150 metres.

f. All civilian spectators and ammunition must be 200 metres from the firing vehicle.

g. Crews must be closed down, with fire extinguishers available.

0555. ***Opening Up Procedure.*** *Explain:* The procedure for opening the hatches is as follows:

a. The commander, using his periscope, is to check the top of the gunner's hatch to ensure that the phosphorus pellet dispersion is complete.

b. The gunner is to open up and check that the commander's hatch is clear.

c. The commander is to open up and check that the driver's hatch is clear.

0556. *Confirm by questions.*

0557. ***First Aid.*** *Explain:* The following first aid is to be taken in the event of any person being burnt or contaminated by phosphorus:

a. Where practicable, immediately immerse the burn area in water, or alternatively, pour liberal quantities of water over the area.

b. Apply a large, wet dressing and ensure that it is kept wet or burning will recommence.

c. No other treatment is to be administered.

d. The contaminated person is to be taken to the nearest medical establishment for treatment as quickly as possible.

e. Under no circumstance is copper sulphate or hydrogen peroxide to be used.

0558. *Confirm by questions.*

Conclusion

0559. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The need to test the dischargers before firing.

(2) The importance of observing the 5 minute wait during the misfire drill.

(3) Observing the safety rules when using the L8 Phosphorus grenade.

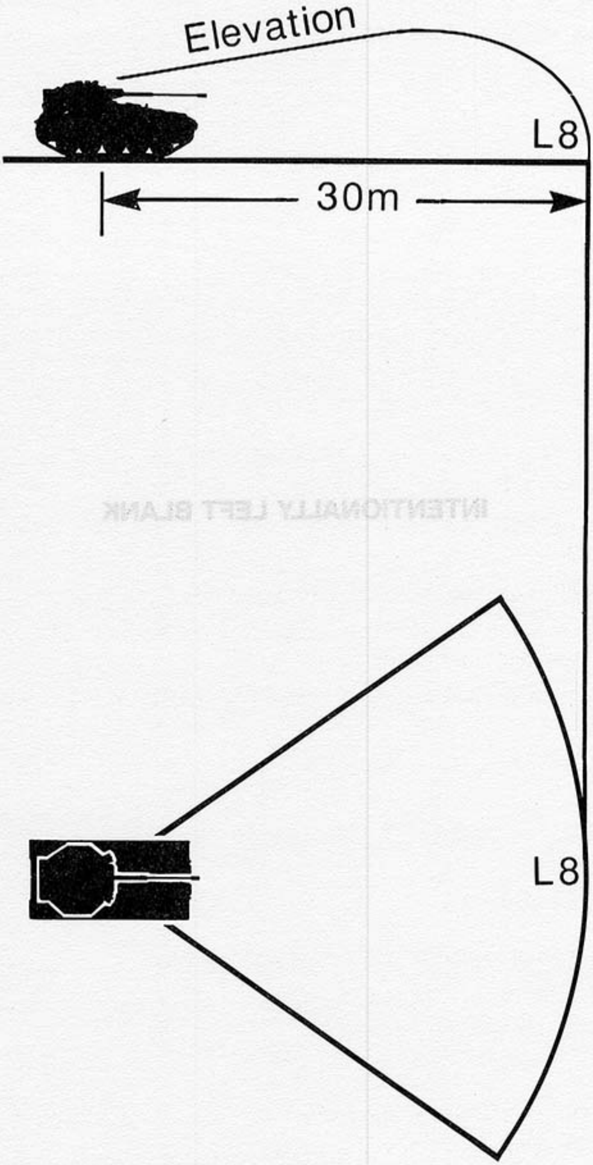
Elevation
L8
30m
L8

Fig 22. — Grenade, Smoke — Arc and Range

INTENTIONALLY LEFT BLANK

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The x1 Optical System

0571. *Explain and demonstrate:*

a. The viewing window for the x1 system is immediately above the x10 sighting system. The window is protected by a spring loaded blackout shutter which can be held in the closed position by a clamp on the right hinge.

b. Inside the sight, is the pivoting x1 laser filter which is moved by the rear of the three control levers situated on the left side of the main case. When the control is in the 'Up' position, the filter, blue in colour, can be seen through the viewing window.

c. A two position flip mirror inside the sight determines whether or not the image path is reflected from the object mirror into the x1 system.

d. The position of the mirror is determined by the centre control lever on the left side of the main case. With the control in the 'Up' (x1) position, the mirror reflects into the x1 window. With the control in the 'Down' position (x10) the mirror is clear of the image path.

e. A circle positioned in the x1 window encloses half the field of view of the x10 optical system. The circle can only be seen when the upper of the two graticule lamp dimmers, situated left of the eyepiece heater switch, is rotated clockwise.

f. The lamp unit is situated forward of the deflection graticule adjuster.

0572. *Allow the squad to examine the sight in turn. Confirm by questions.*

The x10 Optical System

0573. *Explain and demonstrate:*

a. The x10 eyepieces, fitted with heaters, are positioned below the x1 window. The 'On'/'Off' switch is situated to the left of the eyepiece.

b. An adjustable face mask fits over the eyepiece.

c. The right eyepiece is mounted rigidly. The left eyepiece, mounted in a movable cradle, can be adjusted by the inter-ocular setting control knob positioned on the left of the main case. The adjustment is recorded on a scale above the left eyepiece inside the x1 window. The eyepieces have fixed focus.

d. The graticule pattern is incorporated within the right eyepiece. The graticule is illuminated by a lamp unit situated in the bottom right side of the main case. The lamp is controlled by the lower graticule lamp dimmer situated left of the eyepiece heater switch.

e. Two graticule adjusters are fitted to the sight. The one for deflection is on the right side and the one for elevation is on the rear face of the main case.

f. The scales on the adjusters are graduated from 0 to 10 mils in one mil intervals with sub divisions of 1/5th of a mil. Each adjuster can be rotated two complete turns, giving an overall movement of 20 mils. The degree of adjustment is read from the index mark engraved on the index drum or index plate as appropriate. Each adjuster can be locked by a clamping lever.

g. Two laser filters, one for each eyepiece, are contained within the sight. The position of the filters is determined by the forward of three control levers on the left of the main case. When the control is in the 'Down' position the filters, blue in colour, can be seen through the eyepieces.

h. Before operating the laser filter control the x1 flip mirror control must be in the 'Down' position.

0574. ***Graticule Pattern.*** *Explain using the Sight Pattern drop* (*see* Fig 24): The sight periscope AV No 52 (Gunners day sight) graticule pattern consists of three parts: the Muzzle Bore Sight (MBS) mark, the 30 mm pattern and the machine gun pattern.

a. *The Muzzle Bore Sight Mark.* Positioned at the top of the graticule pattern is an inverted triangle. The bottom of the triangle is used during sight adjustment.

b. *The 30 mm Graticule Pattern.* The curved centre line gives allowance for ➤ sight off-set. It is made up of dots, single and double lines and two lazy 'T' marks. The lazy 'T' marks are an immediate reference to 800 metres. The dots and single and double lines are aiming marks used to engage targets between 400 and 2000 metres. Range is marked in even numbers from 4 to 20, alternately either side of the centre line. Odd numbered ranges are indicated by the dots in the centre line. The lines and numbers to each side of the centre line provide an 'aim off' reference for the engagement of moving targets.

c. *The Machine Gun Graticule Pattern.* Range is marked in 100s of metres from 500 to 2000 down the left edge of the pattern. Use is made of the 30 mm centre line up to 950 metres and thereafter a series of plus signs and dots at 50 metre intervals continue the line up to 2000 metres. Lead lines, located either side of the 30 mm range increments, allow for aim off up to 950 metres.

0575. ***Graticule Pattern, APDS Scale.*** *Explain using the Sight Pattern drop (see* Fig 24A): The graticule pattern consists of five main parts:

a. *The Muzzle Bore Sight Mark (MBS).* This is positioned at the top of the centre pattern. It is a dot with a circle surrounding it. The dot is used as the reference point during bore sighting. It defines the axis of the bore at the muzzle of the gun.

b. *30 mm APDS Graticule Pattern.* This is a curved centre line comprising a series of crosses and dash-dot-dashes. These markings define the ranges from 400 to 2600 metres and are at 200 metre intervals. The range is marked in even numbers from 4 to 24. Left and right of this centre line of markings are the range distances, and dashes which provide aim off points, used in engagements against moving targets. Thus lazy V's, > <, at 1000 metres provide a quick reference or 'Battle sight range'.

c. *30 mm HE Graticule Pattern.* This is positioned on the right of the whole pattern under the letters HE. The set of numbers define ranges at 400 metre intervals marked 4 to 20, from 400 metres to 2000 metres.

d. *MG Graticule Pattern.* This is the left set of numbers under the letters MG which indicate ranges with the centre line of markings giving the aiming points. Numbers are marked from 6 to 14 representing 600 to 1400 metres. The MG aim off marks are to the left and right of the numbers representing the APDS ranges.

e. *Stadiametric Rangefinder.* At the top of the graticule pattern above the MBS mark are a series of horizontal lines producing a curved pattern, dropping from left to right. The lines are numbered from 6 to 24. These represent ranges from 600–2400 metres. Underneath these markings is a line marked 'BMP TRACK UP'. Fitting a BMP between these stadia markings, so that one of the numbered lines is on its turret top and the base line is on the lower BMP tracks, gives the distance from the sight to the target.

0575A. *Confirm by questions, practice taking readings.*

Adjustment and Operation

0576. ***Face Mask and Inter-Ocular Setting.*** *Explain and demonstrate:*

a. Remove the eyepiece cap.

b. Position the forehead against the mask, adjust the mask until the most comfortable position is obtained:

(1) Unlock the locking nuts on the two adjusters, situated on the top right and bottom left of the metal frame of the mask.

(2) Rotate the two adjusters until the desired position is obtained.

(3) Lock the locking nuts to secure the face mask.

c. Rotate the inter-ocular setting control until a single circular view is obtained. Note the setting.

0577. ***Graticule Illumination (x1 and x10).*** *Explain:*

a. Set the battery master switch to the 'On' position.

b. Turn the graticule lamp dimmer clockwise and adjust the brilliance as required.

0578. ***The Eyepiece Heater.*** *Explain and demonstrate:*

a. Set the heater switch to the 'On' position.

b. The warning lamp besides the switch should illuminate.

0579. *Confirm by practice.*

The Sight Mounting and Washer System

0580. *Explain and demonstrate:*

a. *Sight Mounting.* The sight is mounted into the turret roof and is secured by four bolts which pass through the outer armour and screw into the main case. The sight is rigid in the mounting and is only removed by REME.

b. *Washer System.* The sight is also fitted with a washer system. The reservoir for the gunner's sight is situated on the right turret wall. The plungers for operating the system are not positioned in the same place for each vehicle. They are sometimes found in the bottom of the sight casing or on the turret roof between the gunner's sight and the commander's sight. Operation of the plunger will deliver water to both the gunner's day and night sight.

0581. *Confirm by questions.*

To Test for Parallax

0582. *Explain and demonstrate:*

a. The test is to be carried out on all sights that have a graticule pattern and are used when direct fire is employed.

b. Lay on to an aiming mark at not less than 600 metres.

c. Move the head while looking at the aiming mark. Should the graticule move with the head, then parallax is present in the sight and must be reported to REME.

0583. *Confirm by questions and practice.*

Servicing

0584. *Explain:* It is important that all optical systems are serviced correctly in order to maintain their accuracy. Incorrect or careless cleaning of lens and glass surfaces must be avoided.

0585. *Seat two of the squad in the turret, the remainder looking in. Instructor on the back of the vehicle. Explain and demonstrate:* The following methods should be adopted:

a. *Object Prisms and Object Glasses.* These are the glass components which are closest to the target and exposed to the weather and traffic film. Remove all mud and film with clean cold water and pat dry with a clean soft cloth or tissue paper (soft toilet paper is both clean and absorbent).

b. *Ocular Prism and Eye Lenses.* These are the glass surfaces nearest to the eye. They are not exposed to mud and traffic film and are usually coated with a bluish anti-reflection coating. Great care must be taken to blow away any grit or dust before cleaning. Clean tissue is to be used. A polish may be obtained by breathing on the glass, but there must be no hard rubbing or saturating with water. If it is not possible to clean an optical surface satisfactorily REME should be informed.

c. *Cleaning Agents.*

(1) Methylated spirits and gasoline may be used with care. Excessive use of these can cause deterioration of the sealing and bonding materials.

(2) No attempt should be made to wipe off mud or grit in a dry state, as this will scratch the glass surface and reduce the efficiency of the instrument.

(3) Any abrasions, chips or scratches, especially radial ones due to wiper action, should be reported to REME for investigation.

(4) Cotton waste must NEVER be used to clean glass surfaces. Even service flannelette, which may well be the cleanest cloth available, is suspect since its heavy woollen texture harbours grit but, if nothing better is available, it may be used with great caution.

0586. ***Inspection.*** *Explain and demonstrate:* Inspect and check for the following:

a. Missing, loose or damaged screws.

b. Damaged seating and locating faces.

c. Condition of:

(1) External finish.

(2) Electrical fittings and switches.

(3) Engraving on scales and readers.

(4) External glass surfaces.

(5) Face masks.

d. Efficiency of locking devices and safety catches.

e. Graticules should be sharp and clearly defined.

f. When looking through an instrument from the object end, the internal optics can be viewed; these should be clean, unfilmed and free from fungus or cracks.

0587. *Confirm by questions and practice.*

Conclusion

0588. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

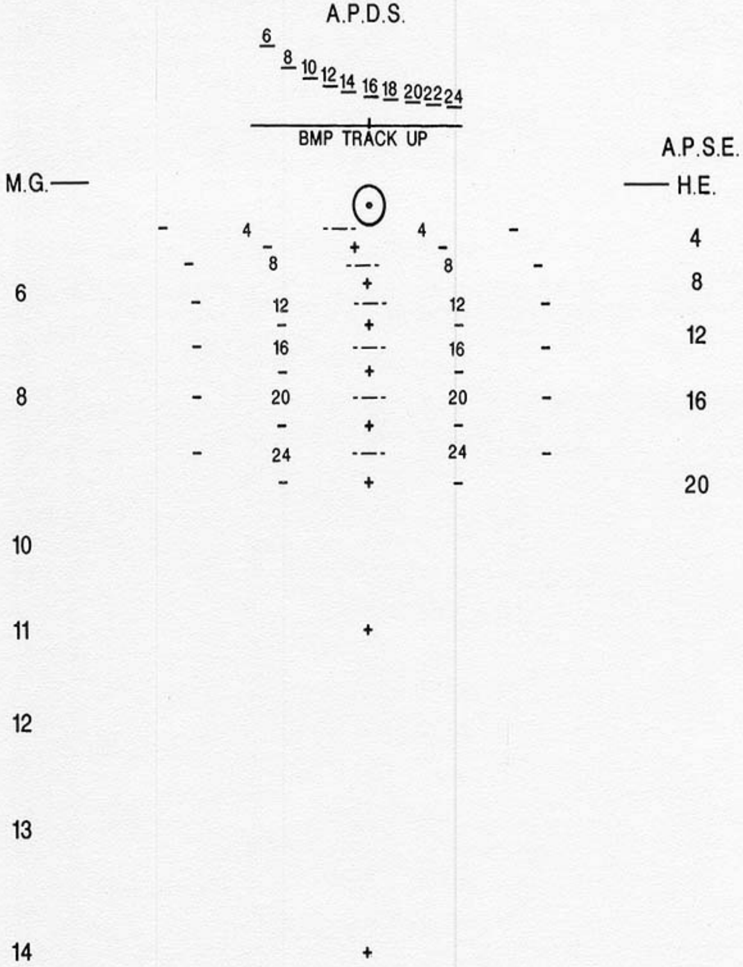
d. *Pack kit.*

e. *Summary. To include the following:*

(1) Care when taking readings.

(2) Remember the importance of the check for parallax.

(3) Careful use of cleaning material on both lens and glass.


A.P.D.S.
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BMP TRACK UP
A.P.S.E.
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NOT TO SCALE

Fig 24A. — Sight Periscope, AV, No. 52, Mk 2 — Graticule Pattern (also used in No. 68 and 75 sights)

The x1 Optical System

05100. *Explain and demonstrate, the squad to examine the sight in turn:*

a. The viewing window for the x1 system is immediately above the x10 sighting system. The window is protected by a spring loaded blackout shutter which can be held in the closed position by a clamp on the left hinge.

b. Inside the sight is a x1 laser filter which is moved by a control on the right side of the sight body. The filter is in the vertical operative position when the control is in the 'Up' position. When the control is in the 'Down' position, the filter is moved to the horizontal position away from the line of sight. The x1 and x10 laser filter control is located on the left side of the sight body on the No 75 sight.

c. A two position flip mirror inside the sight determines whether or not the image path is reflected from the object mirror into the x1 system.

d. The position of the mirror is determined by the rearward of the two controls on the left side of the main case. With the control in the 'Up' (x1) position, the mirror reflects into the x1 window. With the control in the 'Down' (x10) position the mirror is clear of the image path.

e. A circle positioned in the x1 window encloses half the field of view of the x10 optical system.

05101. *Confirm by questions.*

The x10 Optical System

05102. *Explain and demonstrate, the squad to examine the sight in turn:*

a. The x10 eyepieces, fitted with heaters, are positioned below the x1 window. The 'On'/'Off' switch is situated to the left of the eyepiece.

b. An adjustable face mask fits over the eyepieces. The mask can be removed by unscrewing the clamping nuts and can be adjusted fore and aft using the two adjusters.

c. Two laser filters, one for each eyepiece, are contained within the sight and are controlled by the forward of the two controls on the left side of the sight body. With the control in the 'Up' position the filters are in the inoperative vertical position. With the control in the 'Down' position, the filters are positioned horizontally over the lines of sight from the eyepieces.

d. The right eyepiece is mounted rigidly. The left eyepiece, mounted in a movable cradle, can be adjusted by the inter-ocular setting control positioned on the left side of the main case. The adjustment is recorded on a scale below the eyepiece. The eyepieces have fixed focus.

e. A graticule pattern is incorporated within the right eyepiece. The graticule is illuminated by a lamp unit situated below the x10 eyepieces. The lamp is controlled by a dimmer situated above the eyepiece heater switch.

f. The electrical circuit of the sight is protected by fuze F3.

g. The object mirror assembly is common to both the x1 and x10 optical systems. It is fitted in the top case by a pivoting mount and trunnions. Tilting of the mirror has the effect of raising or lowering the line of sight. The angle of the mirror is controlled by the rotation of the object mirror tilting control on the left side of the main case.

05103. ***AV 75 Graticule Pattern.*** *Using the Sight Pattern drop explain* (*see* Fig 28): The graticule pattern of the commander;s day sight is identical to that of the gunner's sight with the addition of a line of lazy 'T' marks positioned left and right of the Muzzle Bore Sight. The horizontal arm of the 'T' mark and the gap between, each measures 1 mil. The 'T' marks are numbered in mils from 2 to 20 left and right of centre. The procedure for their use in conjunction with the Traverse Indicator is taught in Gunnery Theory.

05104. *Explain* (*see* Fig 26): The AV 68 Graticule Pattern consists of a vertical and a horizontal line in form of a cross. Both lines are marked in sub divisions, each of 5 mils.

05105. ***Graticule Pattern APDS Scale.*** *Explain using the Sight Pattern drop (see* Fig 24A): The graticule pattern consists of five main parts:

a. *The Muzzle Bore Sight Mark (MBS).* This is positioned at the top of the centre pattern. It is a dot with a circle surrounding it. The dot is used as the reference point during bore sighting. It defines the axis of the bore at the muzzle of the gun.

b. *30 mm APDS Graticule Pattern.* This is a curved centre line comprising a series of crosses and dash-dot-dashes. These markings define the ranges from 400 to 2600 metres and are at 200 metre intervals. The range is marked in even numbers from 4 to 24. Left and right of this centre line of markings, are the range distances and dashes which provide aim off points used in engagements against moving targets. Two lazy V's, > <, at 1000 metres provide a quick reference or 'Battle sight range'.

c. *30 mm HE Graticule Pattern.* This is positioned on the right of the whole pattern under the letters HE. The set of numbers define ranges at 400 metre intervals marked 4 to 20, from 400 metres to 2000 metres.

d. *MG Graticule Pattern.* This is the left set of numbers under the letters MG which indicate ranges with the centre line of markings giving the aiming point. Numbers are marked from 6 to 14 representing 600 to 1400 metres. The MG aim off marks are to the left and right of the numbers representing the APDS ranges.

e. *Stadiametric Rangefinder.* At the top of the graticule pattern above the MBS mark are a series of horizontal lines producing a curved pattern dropping from left to right. The lines are numbered from 6 to 24. These represent ranges from 600-2400 metres. Underneath these markings is a line marked 'BMP TRACK UP'. Fitting a BMP between these stadia markings, so that one of the numbered lines is on its turret top and the base line is on the lower BMP tracks, gives the distance from the sight to the target.

05105A. *Confirm by questions.*

The Sight Mounting

05106. *Explain and demonstrate* (*see* Fig 29):

a. The sight is mounted in the mounting periscopic sight No 45. This mounting enables the whole sight to be rotated 500 mils left or right of centre.

b. It consists of a fixed half mounted in the turret roof and a rotary half into which the sight is secured. A clamp in a slot in the traverse arc is used to clamp the two parts together.

c. A scale and pointer allows the commander to read the amount by which the sight is traversed away from the centre zero position. A spring loaded plunger, fitting into a recess in the traverse arc, determines the line-up position and enables it to be selected.

d. Initial setting up of the correct line-up position can be achieved by adjustment of the antagonistic bolts on either side of the plunger assembly.

05107. *Confirm by questions and practice.*

Adjustment and Operation

05108. ***Face Mask and Inter-Ocular Setting.*** *Explain and demonstrate:*

a. Remove the eyepiece cap.

b. Position the forehead against the mask, adjust the mask until the most comfortable position is obtained:

(1) Unlock the locking nuts on the two adjusters, situated on the top right and bottom left of the metal frame of the mask.

(2) Rotate the two adjusters until the desired position is obtained.

(3) Lock the locking nuts to secure the face mask.

05109. ***Graticule Illumination.*** *Explain and demonstrate:*

a. Set the battery master switch to the 'On' position.

b. Turn the graticule lamp dimmer clockwise and adjust the brilliance as required.

05110. ***The Eyepiece Heater Operation.*** *Explain:*

a. Set the heater switch to the 'On' position.

b. The warning lamp beside the switch should illuminate.

05111. ***Sight Traverse.*** *Explain and demonstrate:*

a. Unclamp the sight mounting by moving the clamp clockwise.

b. If the sight is in the lined up position, pull the plunger to the left.

c. Rotate the sight as required.

d. The amount of traverse of the sight can be read off the scale which is positioned on the underside of the turret roof.

e. The sight can be re-clamped in any position by moving the clamp anti-clockwise.

f. If line-up is required, rotate the sight until the plunger engages in the recess of the traverse arc.

05112. *Confirm by questions and practice.*

Parallax and Servicing

05113. *Teach by question and answer and related to the gunner's sight.*

05114. *Confirm by practice.*

Conclusion

05115. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The importance of ensuring that the servicing is carried out correctly, in particular the cleaning of the lenses.

(2) That the squad understand the operation of all components. This will allow them to use the sight to its full advantage.

(3) Remember the importance of the check for parallax.

05159. ***Anti-Personnel Grenades.*** *Explain:*

a. Three grenades in a container, situated on the right wall of the hull.

b. Three grenades in a container, situated on the left wall of the hull.

05160. *Confirm by questions using the stowage diagram.*

05161-05164. *Reserved.*

Conclusion

05165. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The importance of correct servicing of both periscopes and seats.

(2) The reason for maintaining the correct stowage position for all ammunition.

Corrections, Misfires and Stoppage Drills

05216. *Exercise the squad in the gun drills — include corrections during firing, misfire and stoppage drill.*

Rangework

05217. *Explain:* Gun drills on the range will incorporate the use of red, green and yellow flags. Guns will be prepared for inspection and inspected by the supervisor/ conducting officer.

Conclusion

05218. ***End of Lesson Drill.***

- **a.** *Questions from the squad on the entire lesson.*
- **b.** *Confirm by questions and practice.*
- **c.** *Normal safety precautions.*
- **d.** *Dismount the L37 machine gun and remove the recuperator.*
- **e.** *Pack kit.*
- **f.** *Summary. To include the following:*
  - (1) The need for the crew to practise frequently in order that the drills become instinctive.
  - (2) The requirement to work together as a crew and to develop team spirit.
  - (3) Emphasize that the inspection of guns and the use of flags is a must during rangework.

05219-05250. *Reserved.* ◄

Chapter 5A
MISCELLANEOUS INFORMATION

LESSON 26. — PREPARATION FOR FIRING AND PRE-FIRING CHECKS

A. INSTRUCTOR'S NOTES

05251. **Aim.** *To teach vehicle and armament preparation prior to Live Firing.*

05252. **Timings.** *Two 40 minute periods.*

05253. **Method.** *A basic instructional period on CVR(W) or CVR(T).*

05254. **Stores.**

CVR(W) or CVR(T)	*1 per squad*
Crewman's helmet	*3 per vehicle*
Tool kit as per CES	*1 per vehicle*
Boresight No 12 Mk 1	*1 per vehicle*
30 mm cleaning valise (complete)	*1 per vehicle*
First aid kit	*1 per vehicle*
Flags, red, yellow and green	*1 of each per vehicle*
Recuperator	*2 per vehicle*
L37A2/A1 GPMG	*1 per vehicle*
Torch RA	*1 per vehicle*
Boresight mask (if night firing)	*1 per vehicle*
Bardic lamp (if night firing)	*1 per vehicle*
Binoculars L12A1	*1 per vehicle*
Cloth/Rags	*As required*
Flannelette	*As required*
Oil XG 276, XG 279, OMD 80, OX 18 and OM 18 LVG/MTI 9150-99-224-5987 lubricant solid film	*As required*
30 mm drill rounds	*As required*
7.62 mm drill rounds	*As required*
Table 6	*As required*
Sandbags	*As required*
Optical tissue	*As required*

05255. **Preparation.**

a. *Prepare the following Board headings:*

Preparation for Firing and Pre-Firing Checks

Aim
30 mm Pre-Firing Checks
L37 Pre-Firing Checks
MBSGD Pre-Firing Checks
Sights
Miscellaneous

b. *Lay out tools on the table and equipment required for the range.*

c. *Ensure that the recuperator is fitted and the weapons function correctly.*

d. *Number the squad and explain the system of change round.*

05256. ***Miscellaneous.*** *This is a practical lesson and as much practice as possible should be given.*

a. *Start the lesson with the squad alongside the vehicle. Subsequently use a student gunner, commander and driver positioned on the vehicle, the instructor to control their actions and the remainder on top of the vehicle looking in.*

b. *At times members of the crew may be involved in several different tasks at once, this will require firm control and supervision by the instructor.*

B. CONDUCT OF THE LESSON

Preliminaries

05257. ***Safety Precautions.*** *Normal.*

05258. ***Revision.*** *Question the squad on:*

a. *The recoil system.*

b. *Rules for stripping.*

c. *Preparation for boresighting.*

Introduction

05259. *Explain:* It is important that the vehicle and its weapon systems are thoroughly prepared and checked prior to live firing, otherwise problems may occur wasting valuable time on the range.

30 mm Gun Preparation

05260. *Explain and where necessary demonstrate:* For the 30 mm gun to function correctly a number of checks must be carried out. These are as follows:

a. The recuperator check. (*Explain:* The REME will also check the pressure of each recuperator prior to firing.)

b. The buffer system check.

c. Firing gear check.

d. The correct application of oils and greases to the components in the top and bottom casings, and all nuts and screws are secure.

e. Dry cleaning the barrel and applying XG 276 to the barrel bearing.

f. Using drill rounds to check the feed and chambering mechanisms.

g. Checking on the gun documents for the remaining number of EFCs for that barrel.

05261. *Explain:* Functional checks should be made of the breech ring assembly and breech block prior to assembly of the main armament.

05262. *Confirm by questions and practice, leaving the gun fully assembled.*

L37 Preparation

05263. *Explain:* The following checks must be carried out on the L37 to ensure its correct functioning:

a. Eight point check.

b. Correctly prepared for firing.

c. L37 mounting and firing gear test.

d. Operation of the trigger bar extension.

05264. *Confirm by questions and practice.*

Multi Barrel Smoke Grenade Discharger (MBSGD)

05265. *Explain:* If L8 grenades are to be fired then a thorough check must be made of the system. The procedure to service and test the MBSGD is as taught in Lesson 19.

05266. *Confirm by questions and practice.*

The Sights

05267. *Explain:* Great care must be taken with the sighting systems and a full check must be made of the complete system as follows:

a. Service all sights.

b. Check the inter-ocular setting and face mask adjustment.

c. Check the illumination of graticule patterns.

d. Check the function of both day sights and, if night firing, the gunner's night sight.

e. Carry out the test for parallax.

f. Carry out the sight alignment procedure.

05268. *Explain:* Prior to sight alignment the barrel damping pads must be checked for the correct setting. This is a REME task.

05269. *Confirm by questions and practice.*

Miscellaneous

05270. *Explain and where necessary demonstrate:* In addition to the checks that have been carried out there are a number of other components that play an important part in the task of firing both weapon systems:

a. *Ammunition Stowage Positions.* Check security and cleanliness, condition of securing straps and netting.

b. *Communications.* Check that all are working correctly.

(1) Communal intercom.

(2) Vehicle radios.

c. *Elevation and Traverse Gears.* Check to include:

(1) Obstructions to path traverse.

(2) 'Coarse' and 'Fine' gears.

(3) Smooth movement of elevation gears.

d. *Turret Rack.* Grease with XG 279 and LVG/MTI 9150-99-224-5987 lubricant solid film.

e. *Fire Extinguishers.* Check that all are stowed securely in correct stowage positions and serviced.

f. *Seats.* Check that seats can be lowered/raised correctly.

g. *Range Stores.* Check that all stores are safely stowed.

h. *REME.* In addition to checking recuperators and barrel damping pads the REME must also gauge and bore the 30 mm barrel prior to firing.

05271. *Confirm by questions and practice.*

Conclusion

05272. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Normal safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The importance of carrying out the correct pre-firing checks.

(2) The need to report to the REME at once all items requiring their attention.

Rearward Action on Cocking

0733. *Demonstrate cocking using the loaded gun. Explain the action in detail using the stripped gun (see* Fig 43):

a. On cocking the gun, the piston and breech block are pulled to the rear by a stud on the inside of the cocking handle slide engaging in a recess on the piston extension. When the working parts are fully to the rear, the sear rises and engages in the bent.

b. The cocking handle must always be pushed fully forward after cocking the gun. If the gun is partially cocked a dangerous situation may occur, in which the breech block may be held back by the base of a round, and a sudden jolt may release it and fire a round.

0734. *Confirm by questions.*

Effect on the Locking Lever on Cocking the Gun

0735. *Explain, using the stripped gun (see* Fig 43): On cocking the gun, as soon as the piston begins to move, the firing pin is withdrawn into the breech block. The breech remains locked during this primary movement ((about 17 mm) (⅝ inch)). Continued movement of the piston causes the locking lever link to rotate forward and up on its axis lifting the locking lever out of engagement with the locking cams. The breech block is jerked slightly backwards. The breech is now fully unlocked.

0736. *Confirm by questions.*

Forward Action on Operating the Trigger

0737. *Explain and demonstrate by operating the trigger on the loaded gun and by using the stripped gun and a belt of four rounds on the feed tray (see* Fig 44):

a. The first round is positioned in line with the chamber and is held in position by the cartridge stop and cartridge guide.

b. On pressing the trigger, the nose of the sear is depressed thus freeing the extension. The main spring pushes the working parts forward. The feed horns strike the base of the round and, assisted by the cartridge guide, feed it into the chamber.

0738. *Confirm by questions.*

Effect on the Locking Lever on Operating the Trigger

0739. *Explain, using the stripped gun* (*see* Fig 45):

a. As the working parts come forward and the round is fed into the chamber, the locking lever is forced down by the locking cams, thus slowing down the forward movement of the breech block. The piston extension, still moving forward, causes the locking lever link to rotate downward and back, thus forcing the arms down to their fullest extent in front of the locking shoulder. The extractor rides over the base of the round and the ejector is compressed. The round is now fully home with the breech locked.

b. The final forward movement of the piston extension drives the firing pin through the breech block on to the cartridge cap and fires the round. The working parts are now fully forward.

0740. *Confirm by questions.*

Rearward Action, Extraction/Ejection and Subsequent Shots

0741. *Cock the loaded gun. Explain, using the stripped gun* (*see* Fig 46):

a. When the round is fired, some of the gases pass through the gas vent into the gas cylinder, strike the head of the piston and drive it to the rear as previously taught (*see* Fig 47).

b. During the primary movement of the piston, when the breech is still locked, the bullet travels the distance from the gas vent to the muzzle.

c. The breech block being jerked back slightly is enough to effect primary extraction of the empty case.

d. When the breech is fully unlocked and the breech block starts its rearward movement, the extractor withdraws the empty case from the chamber. The ejector forces it from the face of the breech block out through the ejection slot.

e. The working parts continue to the rear and the return spring is compressed, the rearward movement of the piston assembly ceases when the piston post contacts the anvil of the buffer which later assists in the forward movement. The anvil recoils on impact and the movement is transferred to the tapered bushing which is forced into the packing causing it to expand slightly and contact the walls of the buffer housing. This causes a braking effect which, assisted by the compressed spring washers, absorbs most of the shock of recoil (*see* Fig 47A).

f. Provided that the trigger is kept pressed, there are rounds in the belt and sufficient gas made available by gas regulator adjustment to cause the working parts to rebound off the buffer, the action of feeding and firing will continue.

g. On releasing the trigger, the sear remains down but the tripping lever rises. As the working parts come to the rear, the end of the piston hits the tripping lever which, in turn, allows the sear to rise and engage in the bent, thus holding the working parts to the rear.

0742. *Confirm by questions.*

Feeding the Rounds

0743. *Using the stripped gun, top cover raised and a four round belt to show the position of the rounds in relation to the feed pawls, explain* (*see* Fig 48):

a. The actuating stud moves up and down the feed channel which in turn moves the feed pawls.

b. The forward movement forces the outer pawls to the right, half feeding the round. The inner pawl rides over the round and settles behind it.

c. The rearward movement forces the inner pawl to the right, fully feeding the round. The outer pawls ride over the next round and settle behind it.

d. The action of fully feeding a round pushes the link of a fired round out of the side of the gun. The last link in a belt can not be pushed out and is cleared during the unloading.

0744. *Confirm by questions.*

Safety Aspects

0745. *Explain and demonstrate, using the stripped gun as necessary:*

a. A later model of the GPMG has a double nosed sear and a modified piston. When the working parts are withdrawn far enough for the breech block to engage behind the round in the feed tray, but not far enough to cock fully on the rear nose of the sear, the front nose of the sear is in a position to engage the piston bent. This prevents any possibility of a round being accidently fed and fired.

b. The safety catch is recessed to take a lug positioned on the underside of the sear.

(1) When the safety catch is put to 'F' (Fire) this recess is directly under the sear lug and allows the sear to be operated. When the safety catch is put to 'S' (Safe) the recess is not in line with the lug, thus preventing operation of the sear.

(2) When the sear is in the lowered position the safety catch cannot be moved because the lug of the sear is in the recess of the safety catch.

(3) If the gun is assembled with the sear in the raised position and the safety catch is at 'S', the gun cannot be cocked because the sear is locked in the up position.

(4) Under no circumstances is the safety catch to be moved whilst the action of cocking is taking place. If the safety catch is moved a dangerous stoppage may occur.

0746. *Confirm by questions.*

Conclusion

0747. ***End of Lesson Drill.***

a. *Questions from the squad on the entire lesson.*

b. *Confirm by questions and practice.*

c. *Safety precautions.*

d. *Pack kit.*

e. *Summary. To include the following:*

(1) The importance of good maintenance.

(2) No unauthorized stripping of the mechanical parts.

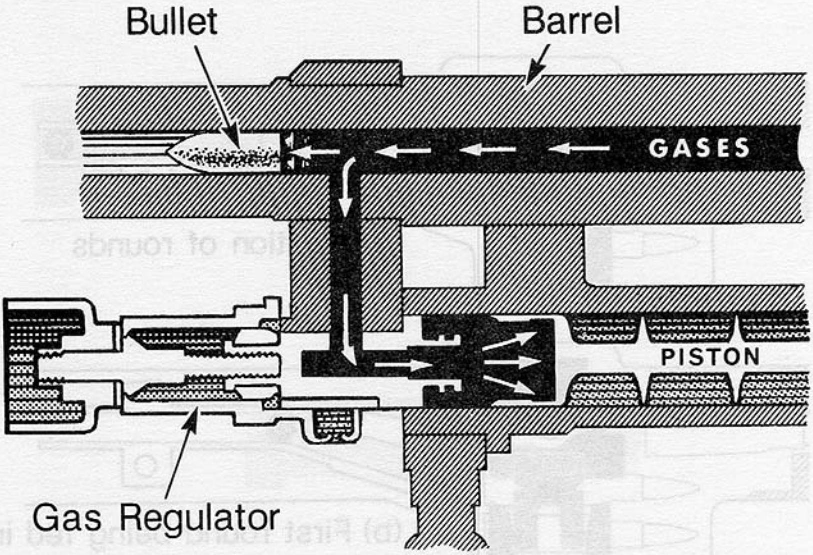

Bullet
Barrel
GASES
PISTON
Gas Regulator

Fig 47. — The Path of the Gases

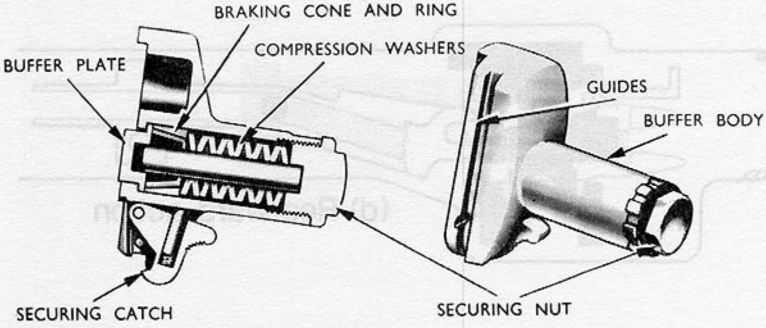
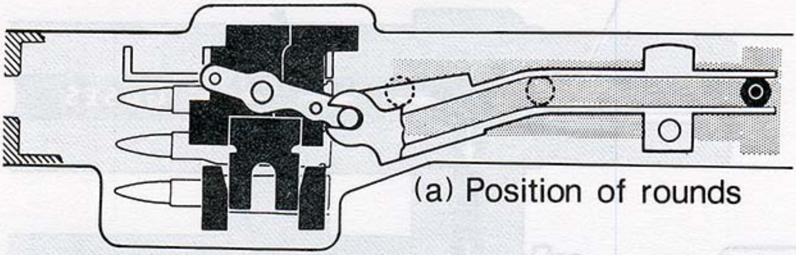
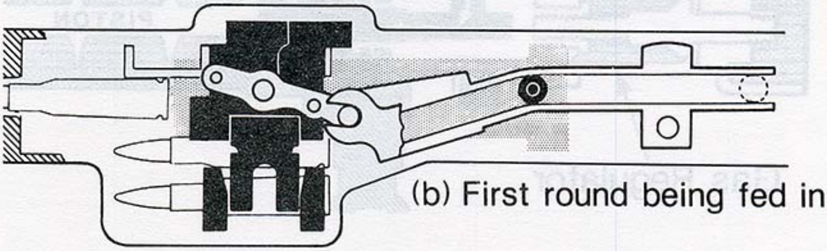

BRAKING CONE AND RING
COMPRESSION WASHERS
BUFFER PLATE
GUIDES
BUFFER BODY
SECURING CATCH
SECURING NUT

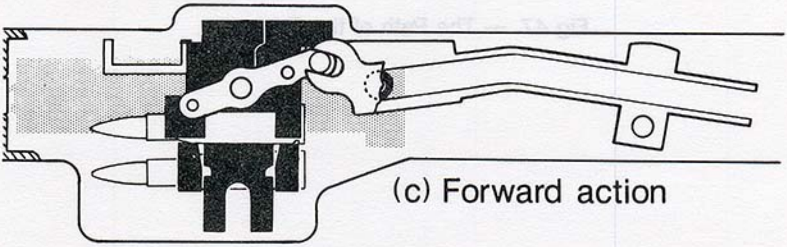
Fig 47A. — 7.62 mm MG Recoil Buffer



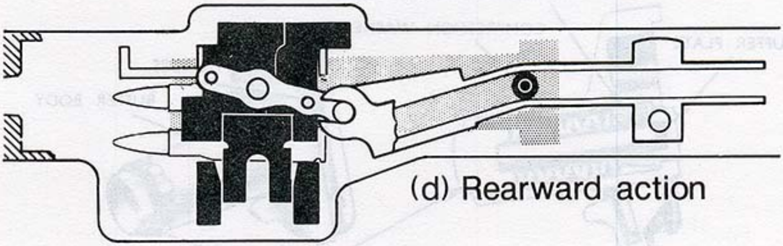
(a) Position of rounds



(b) First round being fed in



(c) Forward action



(d) Rearward action

Fig 48. — The Feed Mechanism

SECTION 6. — 30 mm GUN RECOIL SYSTEM

A. INSTRUCTOR'S NOTES

0748. **Aim.** *To teach the components and operation of the recoil system for the 30 mm Gun to commanders and instructors as additional information.*

0749. ***Timings.*** *One 40 minute period.*

0750. ***Method.*** *An information period for commanders and instructors on the gun stand.*

0751. ***Stores.***

Gun stand	*1 per squad*
Diagram/model of recoil system	*As required*
MG cleaning rod	*1 per gun*
30 mm cleaning rod handle	*1 per gun*
Hold back tool 30 mm	*1 per gun*
Hook, breech ring assembly	*1 per gun*
Screwdriver cabinet	*1 per gun*
Oil OM 18	*As required*
Cloth/rags	*As required*
Recuperator/and model if available	*1 per gun*
Table	*1 per squad*

0752. ***Preparation.***

a. *The following lesson plan headings should be used:*

Recoil System Components and Operation

Aim
Buffer/Replenishment Components
Recuperator Components
Operation of Buffer System? Recuperator

b. *Ensure that the model of the system is lubricated to make parts move freely during the demonstration.*

c. *Position the squad behind the table and to the right of the gun, allowing unobstructed movement between table and gun.*

d. *Remove the top casing from the gun, place in recuperator without 'domed cap', or a model of the recuperator.*

e. *Note that Components, Servicing and Testing was included in Lesson 12.*

0753. ***Miscellaneous.*** *The breech ring assembly can be slid back and forth in the bottom casing to simulate the recoil and run-out at the relevant stage of the lesson. This will assist in relating to what stage the gun is set at.*

B. CONDUCT OF THE LESSON

Preliminaries

0754. ***Safety Precautions.*** *Normal.*

0755. ***Revision.*** *Identify the main components to be dealt with in this lesson, and the purpose of the recoil system.*

Introduction

0756. *Explain:* As instructors or commanders it is essential to understand the detailed operation and workings of the recoil system. With this knowledge a failure in the system can be swiftly identified, and either rectified or reported on.

Components

0757. *Explain and identify using diagram/model:* The recoil system consists of three major parts: the buffer and replenisher (fixed together), and the recuperator (*see* Fig 14).

0758. ***The Buffer.*** *Explain:* This has fixed and movable components:

a. *Fixed Components.*

(1) *The Cylinder.*

(2) *The Tapered Control Rod and Control Rod Extension.*

(3) *A Runout Control Chamber.* Behind the control rod extension.

(4) *Front End Cap.*

(5) *The Packing Nut.* This has sealing rings, a locking washer and wiper ring.

(6) *A Close Fitting Washer.*

(7) *An External Pipe.*

b. *Movable Components.* The piston rod, shaped at the front forming a piston head, has the following components:

(1) *A Brass Piston Ring.*

(2) *A Nut.*

(3) *The Choke.*

(4) *A Series of Holes.*

Note: One pint of oil OM 18 tops up the cylinder.

0759. ***The Replenisher.*** *Explain:* This also consists of fixed and movable components:

a. *Fixed Components.*

(1) *The Cylinder.* This has a filler plug at the top which incorporates a snifter air release valve.

(2) *The Strainer, Spring and Two Drillings.* The drillings allow the oil to flow from the replenisher to the gallery just below the strainer.

(3) *The Piston Guide.* This has a series of washers and sealing rings.

b. *Movable Components.* This is a spring operated piston, incorporating a 'tell tale' rod which has three annular grooves.

0760. ***The Recuperator.*** *Explain, demonstrate and identify:* The recuperator is housed in the bracket on the right hand side of the breech ring and consists of the following:

a. *A Cylinder.* This has a screw fitted which is the oil filler plug for lubricant OM 18 with a reservoir, felt washer and sealing rings.

b. *A Piston.* This incorporates a shrader valve for charging purposes. To recharge is a REME task, to a pressure between 480 and 500 lbs/in^2. The valve is covered by a domend cap to protect it. It also forms a point of contact with the bearing plug fitted into the rear cover. The cap has two projections which fit into recesses in the bottom casing.

0761. *Confirm by questions.*

Operation

0762. *Explain and demonstrate but take each phase in turn and use the gun in conjunction with the model to ease understanding. For example explain and show the action on firing around the gun, and move on to the model to cover detail.*

0763. ***Buffer and Replenisher.*** The buffer absorbs recoil energy, controls the length and speed of recoil and the final movement of runout. As the breech mechanism recoils, the buffer piston rod is drawn rearwards by the breech ring. During this movement, oil is forced from the rear of the piston head, through holes to the front of the piston head through the choke. The choke moving over the tapered control rod, regulates the speed of recoil.

0764. During recoil, oil is forced through the gallery at the rear of the cylinder and then through a small external oil pipe to the front of the buffer cylinder. The replenisher piston moves inwards under the pressure of the spring and forces oil from the replenisher into the front of the buffer cylinder to compensate for the increased capacity due to the buffer piston moving out of the buffer cylinder. In addition, a limited amount of oil is forced to the rear through four holes in the control rod extension locking nut. This oil enters the run out control chamber at the end of the piston rod.

0765. *Confirm by questions.*

0766. ***Run Out.*** *Explain and demonstrate:* The recuperator returns the gun to the run out position. During run out the oil moves in the reverse direction. As the gun nears the run out position, the control rod extension enters the control chamber in the piston rod extension, where oil escape is restricted and run out speed is controlled to the point where the breech ring comes to rest against the buffer pad. This expansion is relieved by the oil forcing its way into the replenisher. The pressure of oil forces the replenisher piston to the rear compressing the piston spring and pushing the tell-tale rod rearwards causing it to protrude through the rear guide of the replenisher. When the oil in the buffer cools and contracts, the pressure on the replenisher piston is relaxed and its spring forces the piston forward.

0767. *Confirm by questions.*

0768. ***Recuperator.*** *Explain and demonstrate:* The recuperator is pneumatic. The initial pressure in the cylinder maintains the gun in the run out position at all angles of elevation when the gun is at rest. When a round is fired and the gun recoils, the recuperator cylinder, attached to the breech ring, moves to the rear over the stationary piston. The air pressure in the recuperator is increased due to the reduced capacity of the cylinder caused by entry of the piston. When recoil ends the compressed air acting against the greater frontal area of the cylinder, forces it forward and returns the breech ring to the run out position.

0769. *Confirm by questions, initially on the recuperator and then the complete operation.*

Conclusion

0770. ***End of Lesson Drill.***

a. *Questions from the squad and further confirmation.*

b. *Normal safety precautions which are to be carried out after the gun is reassembled.*

c. *Pack kit.*

d. *Summary. To include the following:*

(1) The purpose of the recoil system.

(2) The importance of system testing to be done on a cold gun.

0771-0775. *Reserved.*

SECTION 7. — 30 mm GUN AMMUNITION

General Note

0776. This lesson provides information as to the make up, composition and characteristics of 30 mm Gun ammunition. It deals also with markings and packaging which will be of use at some stage during an instructor's career. For example, taking batch numbers after an ammunition incident for a report.

0777. Information is also contained on the composition of rounds in great detail, and this is not only of interest to the instructor for background knowledge, but will assist him in understanding the detailed workings, which at some stage during his employment he may be required to research in greater detail for presentations.

0778. Soldiers on cadres will be given enough information during lectures and on the Introduction and Handling 30 mm Gun lesson, for them to successfully identify the natures and be aware of the basic characteristics.

0779. This information is published in lesson form for use in a Schools Cadre.

A. INSTRUCTOR'S NOTES

0780. ***Aim.*** *The aim of the lesson is to teach the characteristics, use and effect of the 30 mm Gun ammunition natures to commanders and instructors.*

0781. ***Timings.*** *Two 40 minute periods.*

0782. ***Method.*** *Central lecture to collected squads.*

0783. ***Stores.***

Video film	*Introduction to CVR(T & W)*
OHP	
Vufoils (Warrior package, if available in unit)	*G201* *G206* *G209* *G251* *G252*

Instructional 30 mm ammunition including:
  - *Round 30 mm AFV APDS L14A2*
  - *Round 30 mm AFV HE L8 and L13*
  - *Round 30 mm AFV PRAC L7 or L12*
  - *Drill Round 30 mm L1A1*
  - *Inspection Round 30 mm L11A1*
  - *Round 30 mm AFV APSE L5A2 (if available)*

Ammunition container assembly L243A1
Tables
Tape Slide sequence

0784. ***Preparation.***

a. *Prepare the following lesson plan headings:*

30 mm Gun Ammunition

Firing Restrictions

b. *Place training natures of 30 mm ammunition on the tables and have a set of drill rounds in their clip.*

c. *Set up video with the 'Introduction to CVR (T & W)' film.*

d. *Set up Tape Slide projector.*

B. CONDUCT OF THE LESSON

Preliminaries

0785. ***Safety Precautions.*** *Normal.*

0786. ***Revision.*** *Introduction to CVR (T & W) and characteristics of the 30 mm Gun.*

Introduction

0787. *Show 'Introduction to CVR (T & W)' video clip. Explain:* All commanders and gunners in Scimitar and Fox must know and be able to identify the various natures and types of ammunition used by the 30 mm Gun.

Drill Ammunition L1A1

0788. *Point out the drill ammunition on the table. Explain:* A drill round is inert. It represents the weight, form and balance of a live round. It is manufactured from two pieces of chromium steel plate, joined at the centre by a screw thread. A resilient plug is set in the base to receive any blow from the armaments firing pin.

Inspection Round L11A1

0789. *Point out the inspection round. Explain:* This is similar to a drill round, and is primarily used by the unit armourer. It does differ in that certain dimensions are held to a tighter tolerance during manufacture of the inspection round, and two pieces of the inspection round are locked together with a sealant, whilst those on the drill round are locked with solder.

Marking

0790. *Explain:* The markings on both the drill and inspection round are stamped on the base of the round. They show:

a. 30 mm AFV — the calibre and role of the armament.

b. L1A1 or L11A1 — the model number, L1A1 drill, L11A1 inspection.

c. INSP or DRILL — the nature of the round.

d. BM — initials or monogram of manufacturer.

e. 86 — year of manufacture.

0791. Rounds can be clipped together. For drill rounds the charger is painted white. During training other coloured chargers may be used in the classroom. The colours will be explained later and the clips are those which have been used on the range.

0792. ***Rounds 30 mm Practice L7 and L12.*** *Explain:* These rounds are similar but the numerical difference describes the way the steel used in the manufacture of the projectile body is processed. *Show vufoil and display a practice round.* The round can be considered in two parts (*see* Fig 49):

a. The projectile.

b. The cartridge.

0793. ***The Body.*** *Explain:* This is machined from steel bar and phosphated to give some degree of rust proofing. The body is streamlined and boat tailed.

0794. ***The Body Cavities.*** *Explain:* Within the body are two cavities.

a. *Front.* This is the largest, housing 26.5 g of inert filling. Its mouth is threaded internally to receive the nose plug.

b. *Rear.* A small cavity houses the tracer shell.

0795. Externally the body has two grooves around its periphery, one to house the driving band and the other to receive the neck of the cartridge case, squeezed into the groove on assembly of the round.

0796. ***Nose Plug.*** *Explain:* This represents a fuze and is screwed into the forward end of the projectile body.

0797. ***Driving Band.*** *Explain:* This is manufactured from sintered iron and is pressed into the forward groove around the projectile body. The sintered iron band does not cause such excessive barrel wear as a steel band.

0798. ***Tracer Shell, L11.*** *Explain:* The L11 series of tracer shell consists of an aluminium alloy container, lined with a waxed paper tube, containing three pellets of tracer composition topped with a thin layer of the same composition, covered by a layer of priming composition. Inserted into the cavity at the rear of the projectile body the tracer shell is retained in position by the mouth of the cavity being swaged — turned inward — against a steel, washer-like, retainer, seated on top of a brass foil closing disc. The tracer composition burns for distances up to 2,000 metres.

0799. *Confirm by questions.*

The Cartridge

07100. *Explain:* The cartridge comprises a cartridge case containing a quantity of propellant and a percussion primer. On assembly of the round, after the application of a sealing compound, the neck of the cartridge case is squeezed into the rear groove around the shell.

a. *Cartridge Case.* Manufactured in brass, the rimless cartridge case is tapered throughout its length and necked at the forward end to mate with the projectile, the mouth of the case abutting the driving band. A groove around the thickened base of the case provides for engagement of the rammer claw and a counterbored threaded hole through the base receives the percussion primer.

b. *Propellant.* The cartridge case is filled with 160 g of NRN 141 propellant.

c. *Percussion Primer L7.* Incorporating an indirect striker, the L7 percussion primer provides an effective gas seal.

(1) *Primer Body.* Basically a brass tube with a flange at the rear end, the primer body has an external thread forward of the flange, to mate with that in the cartridge case and a bore with three diameters, one of which is threaded. The forward portion of the bore, counterbored to receive a millboard closing disc, acts as a container for 0.97 g of gunpowder, being closed at the rear by the insertion of the percussion cap holder. To the rear of the holder the smallest portion of the bore houses the indirect striker.

(2) *Cap Holder.* The cap holder is a flanged brass item with an external thread, mating with that in the primer body and a recess, with a central anvil, at the rear to receive the percussion cap containing a small quantity of VH2 composition. Two fire holes passing through the holder from the bottom of the recess are closed with a paper disc.

(3) *Indirect Striker.* Separated from the percussion cap holder by either a sealing ring or washer, the indirect striker has a head with a tapered seating at the rear and a rounded point projecting from the front face. To the rear of the head, a parallel stem passes through the cap holder, its end face presented to the ordnance firing pin.

07101. *Confirm by questions.*

Marking

07102. *Explain:* The practice round is marked as follows:

a. *Projectile.* Painted Deep Saxe Blue, indicating its practice nature, the shell is marked with a letter 'T', in White, to indicate the presence of a tracer element.

b. *Cartridge.* The natural brass coloured cartridge is marked in Black as follows:

(1) Nature of round, abbreviated e.g: PRAC.
(2) Model number of round L7A4.
(3) Basic details underlined.
(4) Initials or monogram of assembler.
(5) Date of assembly — month and year.

In addition the following permanent markings are stamped on the base of the cartridge case before filling:

(6) 30 mm AFV.
(7) Year of manufacture — month and year.
(8) Initials or monogram of manufacturer.
(9) Lot number.

c. The plastic clip fitted to the charger is coloured Deep Saxe Blue and has three evenly spaced 12 mm holes.

07103. The practice round's MV is 1080 metres/second.

07104. *Confirm by questions.*

Service Natures

07105. *Explain:* The HE and APDS natures of service ammunition are used with the Warrior infantry variants. *Place examples on table.*

Round 30 mm AFV HE L8 and L13

07106. *Show vufoils. Explain:* The L8A2 and L13A1 versions of the HE round differ in the composition of the steel used in the manufacture of the projectile body. The L13 model is leaded to aid the manufacture when swaging the projectile body to retain the tracer shell in position. The projectile comprises the body, fitted with driving band and tracer shell common to the practice round, filled with 25.6 of Torpex 2 (HE) and fitted with a nose fuze (*see* Fig 50).

Fuze Nose Percussion Direct Action L86A2 and A3

07107. *Explain:* The fuze includes a body, striker assembly, detonator assembly, base plug and magazine.

a. *Body Fuze.* Manufactured from aluminium alloy, the body is machined internally to accommodate the working parts. Below the ogive it is screw threaded externally for insertion into the nose of the projectile, and internally to accept the base plug.

b. *Striker Assembly.* The spring-loaded striker is positioned above the detonator assembly and is restrained from moving downwards by a circular aluminium segmented locking ring (in six segments) which, in turn, is surrounded by a phosphor-bronze coil enclosed in a split brass collar. Above the locking ring is a pressure ring with an inner chamfered surface. The striker head contains five stainless steel balls which are positioned round this surface. The striker spring is supported by a guide rod, the top of which is contained in a recess in the guide cup. The spring is assembled under compression. Modifications to the striker spring and pressure ring, improving the self-destruct timings are included in the L86A3 version.

c. *Detonator Assembly.* The detonator contains 0.15 g of an explosive composition and is positioned in a stainless steel shutter housed between two segments extending from the forward face of the base plug. The shutter is angled so that the detonator is misaligned with the striker, being held in this position by two centrifugal bolts which, in turn, are prevented from moving outwards by the split ring surrounding them.

d. *Magazine.* Containing approximately 0.384 g of composition exploding (CE) in three equal increments, the magazine screws into the base plug to protrude rearward into the main filling of the shell. The base plug is bored centrally and the channel so formed links the magazine with the detonator housing and is stemmed with CE to provide a detonating train.

07108. *Confirm by questions.*

Fuze Action

07109. *Explain:* The fuze actions as follows:

a. *Set-Back.* Initially, all parts in the fuze set-back and become locked, thus ensuring bore safety (*see* Fig 51).

b. *Rotation.* The projectile commences to rotate under the influence of the rifling and the force of set-back eases until the spin has increased sufficiently for the following actions to take place as a result of centrifugal force:

(1) *Detonator Assembly.* The split ring opens and the two centrifugal bolts disengage from the shutter which is then free to rotate under its own weight and to assume a vertical position, bringing the detonator in line with the striker. This occurs when the projectile is about one metre beyond the barrel muzzle. At this stage the striker mechanism is still inoperative.

(2) *Striker Assembly.* The five stainless steel balls in the striker head commence to move outwards and up the chamfered surface of the pressure ring. This action causes the striker to rise, further compressing its spring. At the same time, the striker ceases to press on the locking ring assembly.

(3) *Locking Ring.* The split brass collar opens outwards into an annular recess in the fuze body and allows the phosphor-bronze coil to unwind and remove its restraint from the segmented locking ring which opens and leaves the striker free to function. Thus, after travelling approximately 20 metres from the ordnance, the fuze is fully armed.

c. *Impact.* During flight, the sensitivity of the fuze is maintained as the effects of centrifugal force are reduced. On impact, the fractional interruption of forward motion is sufficient to permit the action of the striker spring to overcome the pressure of the five stainless steel balls against the pressure ring and, as they move inwards towards their original position, the striker spring is able to exert itself and force the striker into the detonator (*see* Fig 52).

d. *Self-Destruction.* Should no impact occur, a self-destructive action takes place as a result of the decrease in spin. A point is reached at approximately 5–10 seconds (equating to ranges of 3,800–4,500 metres) when the gradually reducing centrifugal force is overcome by the pressure of the striker spring and the striker is able to penetrate the detonator.

07110. *Confirm by questions.*

Cartridge

07111. *Explain:* The cartridge employed with the HE round is identical with that used for the PRAC round.

Marking

07112. *Explain:* The HE round is marked as follows:

a. *Projectile.* Painted Golden Yellow, indicating its HE nature and associated hazard, the projectile is marked with a letter 'T', in Black, to indicate the presence of a tracer element.

b. *Cartridge.* The cartridge is marked in a similar manner to that forming part of the practice round, the abbreviation HE being used to indicate the nature of the round.

c. The plastic clip fitted to the charger is coloured Golden Yellow and has only one centrally placed 12 mm hole.

d. The HE round's MV is 1080 metres/second.

Round 30 mm AFV APDS L14A2

07113. *Show vufoil. Explain:* APDS is usually called SABOT. The APDS shot comprises the base, fitted with a driving band, in which the rear end of a hard core — the penetrator — sits, the assembly being joined together by the sabot which, enclosing the penetrator, is secured to the forward end of the base. Also included is a tracer element, pressed into the base of the penetrator (*see* Fig 53).

a. *Base.* An aluminium alloy item, the base is recessed at the forward end, to receive the end of the penetrator and at the rear, to provide a conical form leading to a small hole entering the forward recess, the hole being closed by the presence of the septum — a thin wall of metal. Externally the base has two grooves around its periphery, one, at the rear, to receive the neck of the cartridge, squeezed into the cannelure groove on assembly of the round, the other, much wider and knurled at the bottom, to receive the driving band. Forward of the driving band groove the diameter of the base is reduced, slightly tapered and partially knurled, with a series of annular grooves around it to receive the sabot. The knurled features provide a key, preventing the driving band and sabot rotating about the base.

b. *Driving Band.* Moulded into its groove around the base, the driving band is of a glass-fibre reinforced plastic material.

c. *Penetrator.* Construction of the boat-tailed penetrator is in two parts — the tungsten carbide penetrator core onto which the zirconium nose tip is pressed, a spigot on the core forming an interference fit with a hole in the tip — the forward end being machined after assembly to form a sharp conical tip. A recess in the base of the penetrator houses a tracer composition which, on firing, burns over a distance of at least 1300 metres.

d. *Sabot.* Injection moulded in glass-fibre reinforced plastic, the sabot encloses the penetrator and is ultrasonically welded to the shot base, fuzed into the grooves around the forward end. Four equally spaced longitudinal grooves, throughout the length of the sabot, reduce to a minimum the thickness of material at their root.

APDS Function

07114. *Explain:* The propellant gases produced on firing the round burn through the septum in the penetrator to ignite the tracer, whilst the stresses imposed on the sabot cause it to split apart and become discarded on leaving the barrel. After approximately 300 metres travelled, air resistance causes the base to part from the penetrator which travels on to the target.

Cartridge

07115. *Explain:* The cartridge and percussion primer of the APDS round is the same as for the HE and PRAC rounds.

Marking

07116. *Explain:* The APDS round is marked as follows:

a. *Projectile.* Black in colour, indicating its AP nature, the shell is marked with a letter 'T', in White, to indicate the presence of a tracer element.

b. *Cartridge.* The cartridge is marked in a similar manner to that forming part of the practice round, the abbreviation APDS being used to denote the nature of the round.

07117. The plastic clip fitted to the charger is coloured Black, with no holes.

07118. The MV for APDS is 1175 metres/second and its usual operating distance is at the limit of tracer burn out, up to 2000 metres.

07119. *Confirm by questions.*

Restrictions

07120. ***Rate of Fire.*** *Explain:* Whilst the various natures of ammunition perform as described users must be aware that ambient temperatures can affect rounds and the misfire drills given in Lesson 10 have been accepted by the Ordnance Board on the understanding that the following rate of fire and procedures are strictly observed.

a. *Up to 30 Degrees Centigrade. Explain:*

(1) No more than 50 rounds are to be fired in one hour.

(2) After firing 50 rounds in one hour, a further 50 rounds may be fired in the next hour.

(3) If further firing is required, the gun must then be allowed to cool for a period of at least two hours. The gauge plug bore must then be passed through the bore. This is a REME task.

(4) Provided the gun passes the test, firing may then continue under the same procedures as given above.

(5) At the conclusion of each practice or during a break in firing the gun must be cleared.

b. *30–60 Degrees Centigrade. Explain:* When firing is taking place in ambient temperatures between 30–60 degrees centigrade, the following procedure is to be applied:

(1) Twenty-four rounds may be fired at any rate of fire followed by:

(2) No more than 21 rounds being fired in each of the next four 30 minute periods until a total of 108 rounds have been fired.

(3) If further firing is required, the gun must then be allowed to cool for a period of at least two hours. The gauge plug bore must then be passed through the bore. This is a REME task.

(4) Provided the gun passes the test, firing may then continue and 24 rounds may be fired at any rate of fire followed by:

(5) No more than 12 rounds being fired in each of the next four 30 minute periods until a total of 72 rounds have been fired.

(6) If further firing is required, the gun must then be allowed to cool for a period of at least two hours. The gauge plug bore must then be passed through the bore. This is a REME task.

(7) Firing may then continue for an indefinite period under the same procedure as given at paragraph **b.** above.

(8) At the conclusion of each practice or during a break in firing the gun must be cleared.

07121. *Confirm by questions.*

Packaging

07122. ***Ammunition Container Assembly L243A1.*** *Explain and show:* This container is used for all natures of 30 mm Gun ammunition and is described as follows (*see* Fig 54):

a. *Outer Container.* A galvanised steel box measuring 335 x 157 x 352 mm (13.6 x 6.18 x 13.84 in). The lid is secured at either end by quick-release catches and is fitted with a vulcanised rubber gasket. There are two metal carrying handles fitted around the catches. The handles fold flat when not in use.

b. *Contents.* Fifteen rounds are contained in five x 3 round chargers, with the chargers uppermost to facilitate removal from the box.

c. *Packing Fitments.* They consist variously of high density polythene moulding and millboard packing pieces and are inserted to prevent movement and damage to the rounds during transportation.

d.	*Weight:*	Empty	5.6 kg (12.3 lb)
		Fitted	19.64 kg (43.2 lb)

07123. *Confirm by questions.*

Characteristics of the Trajectory and Penetrative Power

07124. *Explain:* The trajectory of the APDS round is basically a flat line as the MV is high. The penetrative power is such that the round is expected to defeat the frontal armour of potential enemy APCs. The MV of HE shot and PRAC ammunition produces a more curved trajectory.

07125. APDS rounds should be used against enemy hard targets such as APCs. HE should be used against emplacements, enemy trench positions, and soft skinned vehicles e.g., trucks, unarmoured helicopters. PRAC rounds represent either SABOT or HE natures but are best used in training against a hard target in order to see strike from the alloy head.

07126. *Confirm by questions.*

Stowage and the Quantity of Ammunition

07127. ***Turret Internal Stowage.*** *Show vufoil and explain:*

a. *Fox.* Ninety-three rounds in total, of which:

(1) Eighty-four rounds immediate supply in the 'ready rounds' container between the gunner and commander.

(2) Nine rounds in clips of three to the rear of the driver's compartment.

b. *Scimitar.* Two hundred and one rounds in total, of which:

(1) Ninety-six rounds immediate supply in the 'ready rounds' container between the gunner and commander.

(2) Eighty-one rounds in a rack to the rear.

(3) Twelve rounds behind the gunner's seat.

(4) Twelve rounds behind the commander's seat.

07128. *Confirm by questions.*

Toxicity

07129. *Explain:* The 30 mm Gun and 7.62 mm CG produce fumes when they are fired. The design of the turret, and the arrangement for spent shell and empty case disposal ensures that most fumes from the armament are extracted through the turret, and any gas build up is negligible. However turret crews must be aware that a toxicity hazard can exist. The symptoms which could occur are:

a. Sudden loss of concentration.

b. Dizziness.

c. Headaches.

d. Sickness.

07130. ***Remedy.*** *Explain:* **During training remove the crewman from the vehicle for the rest of the day and encourage him to walk around in the fresh air for 60 minutes. Even if he feels well enough to return to his vehicle after 60 minutes he must not be allowed to do so. If he is still suffering the effects of toxicity poisoning he must seek medical help.**

07131. *Confirm by questions.*

Conclusion

07132. ***End of Lesson Drill.***

a. *Questions to and from the squad on the lesson.*

b. *Normal safety precautions.*

c. *Pack kit.*

d. *Summary. To include the following:*

(1) Recognition of the training and service natures of 30 mm ammunition.

(2) The MVs of SABOT and shell ammunition.

(3) Restrictions on firing due to temperatures.

(4) Symptoms and remedy for toxicity effects.

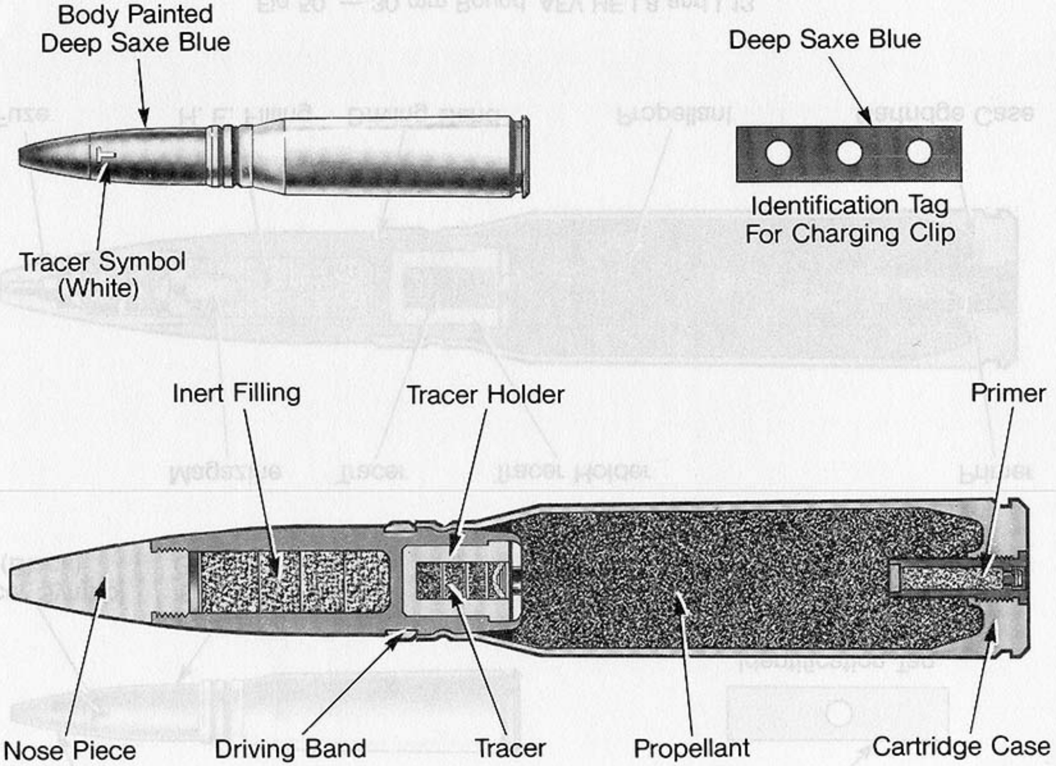

Body Painted
Deep Saxe Blue
Tracer Symbol
(White)
Deep Saxe Blue
Identification Tag
For Charging Clip
Inert Filling
Tracer Holder
Primer
Nose Piece
Driving Band
Tracer
Propellant
Cartridge Case

Fig 49. — 30 mm Round, AFV PRAC L7 and L12

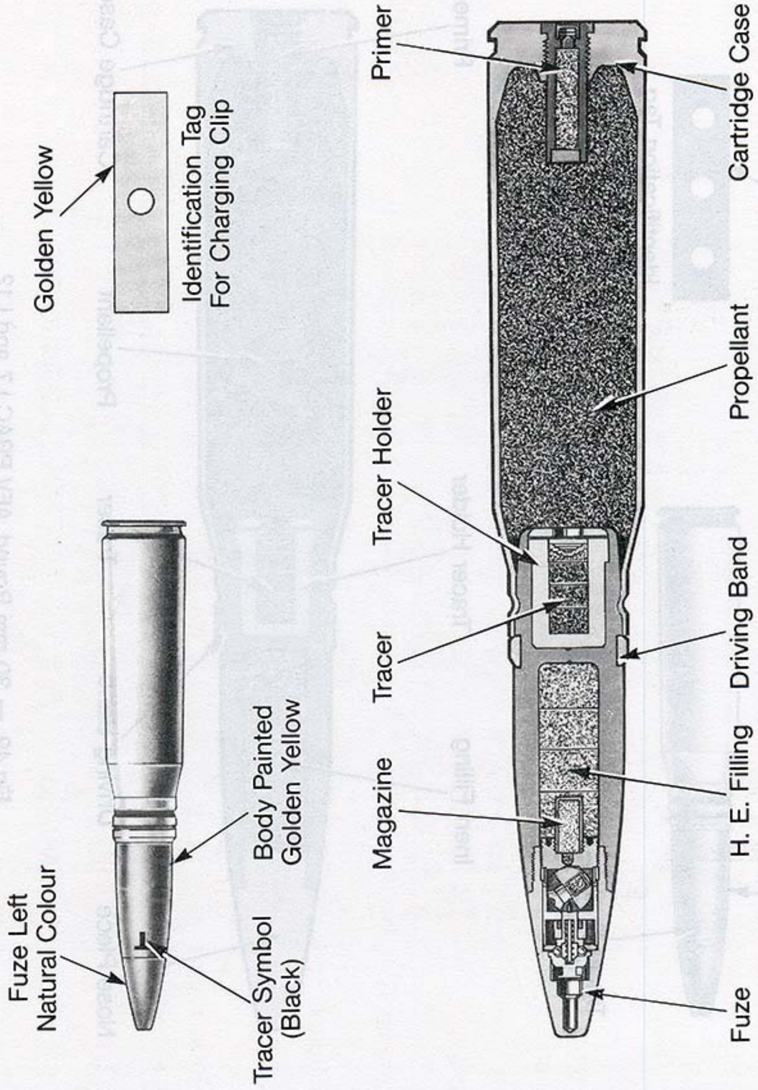

Fuze Left
Natural Colour
Tracer Symbol
(Black)
Body Painted
Golden Yellow
Golden Yellow
Identification Tag
For Charging Clip
Fuze
Magazine
H. E. Filling
Tracer
Driving Band
Tracer Holder
Propellant
Primer
Cartridge Case

Fig 50. — 30 mm Round, AFV HE L8 and L13

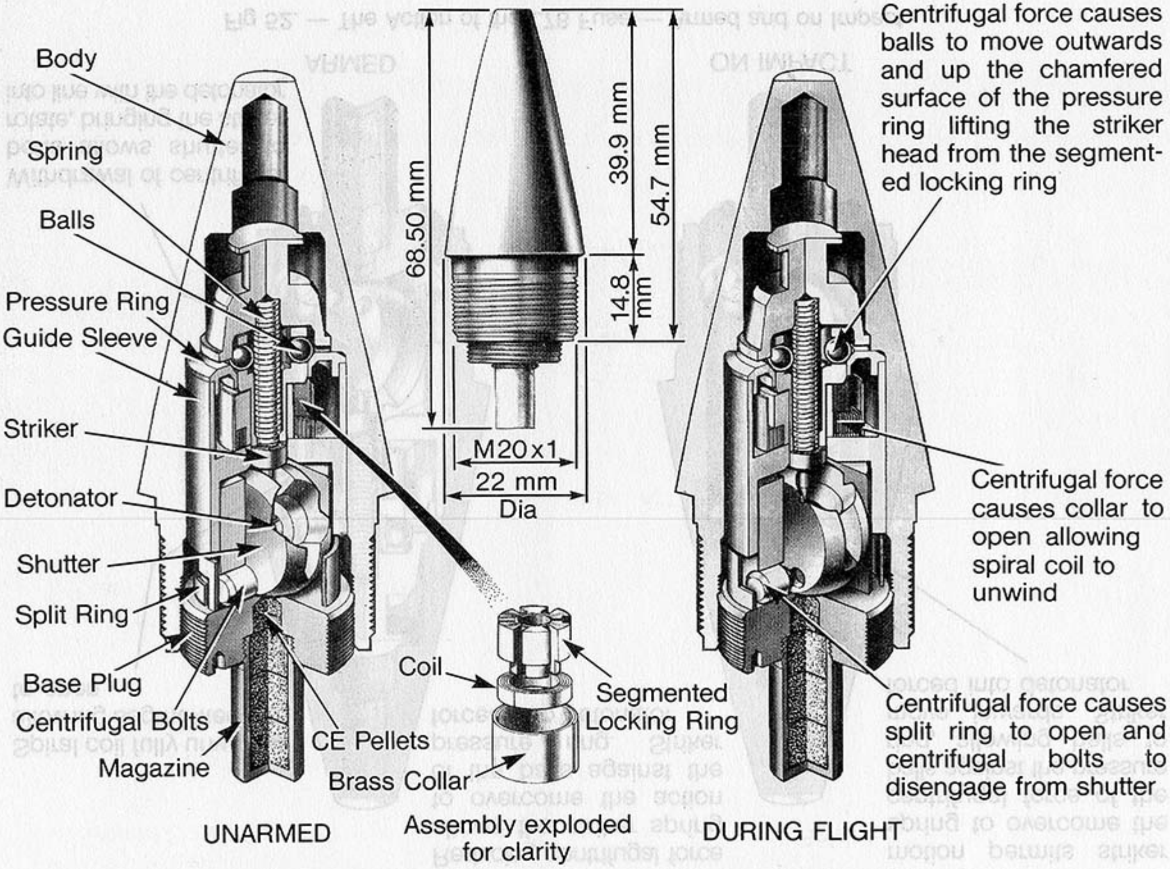
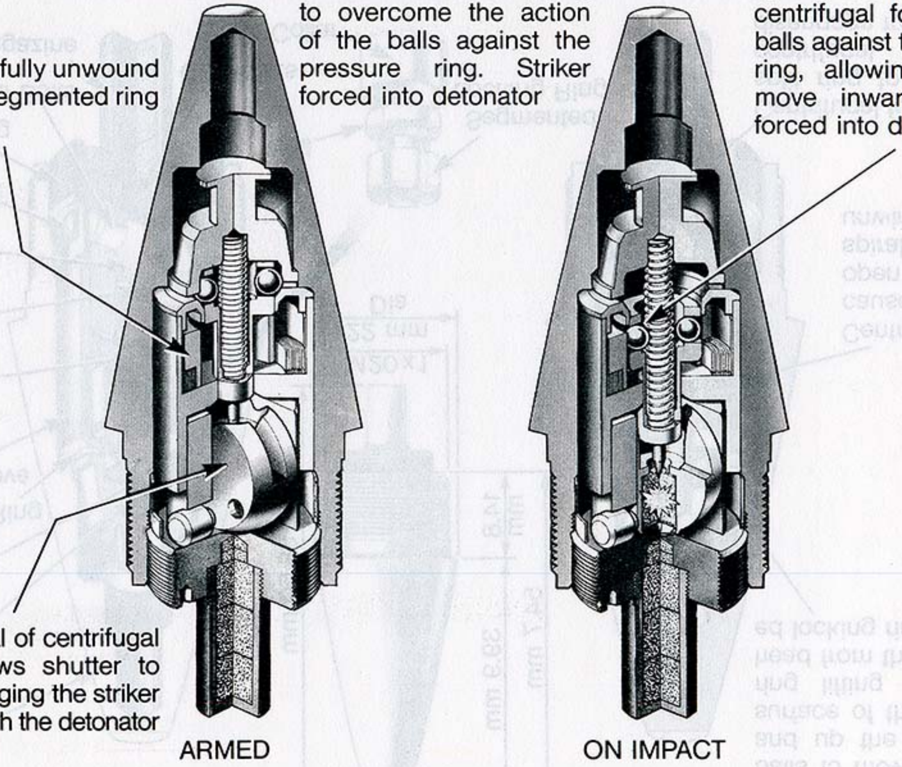

Body
Spring
Balls
Pressure Ring
Guide Sleeve
Striker
Detonator
Shutter
Split Ring
Base Plug
Centrifugal Bolts
Magazine
CE Pellets
68.50 mm
39.9 mm
54.7 mm
14.8 mm
M20 x1
22 mm Dia
Coil
Segmented Locking Ring
Brass Collar
Assembly exploded for clarity
UNARMED
DURING FLIGHT
Centrifugal force causes balls to move outwards and up the chamfered surface of the pressure ring lifting the striker head from the segmented locking ring
Centrifugal force causes collar to open allowing spiral coil to unwind
Centrifugal force causes split ring to open and centrifugal bolts to disengage from shutter

Fig 51. — The Action of the L68 Fuse — Unarmed and During Flight



Spiral coil fully unwound allowing segmented ring to open

Withdrawal of centrifugal bolts allows shutter to rotate, bringing the striker into line with the detonator

SELF - DESTRUCTION
Reducing centrifugal force allows the striker spring to overcome the action of the balls against the pressure ring. Striker forced into detonator

Interruption of forward motion permits striker spring to overcome the centrifugal force of the balls against the pressure ring, allowing balls to move inwards. Striker forced into detonator

Fig 52. — The Action of the L78 Fuse — Armed and on Impact

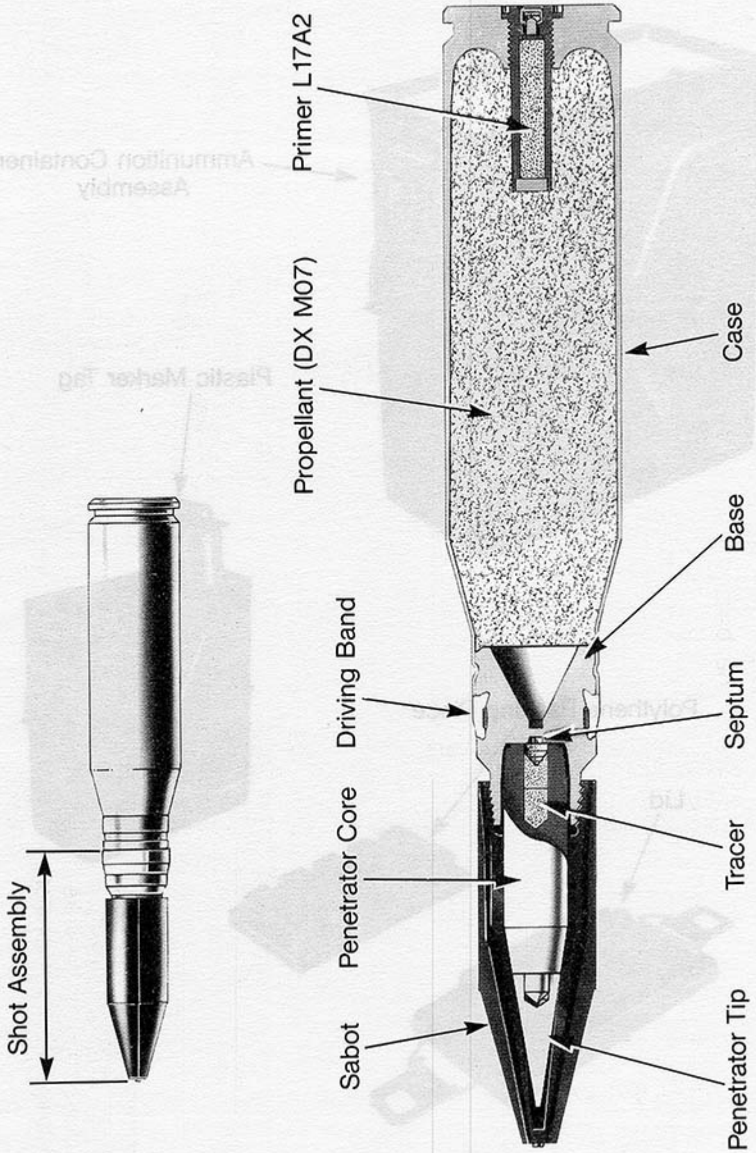

Shot Assembly
Sabot
Penetrator Core
Driving Band
Propellant (DX M07)
Primer L17A2
Penetrator Tip
Tracer
Septum
Base
Case

Fig 53. — 30 mm Round, AFV APDS

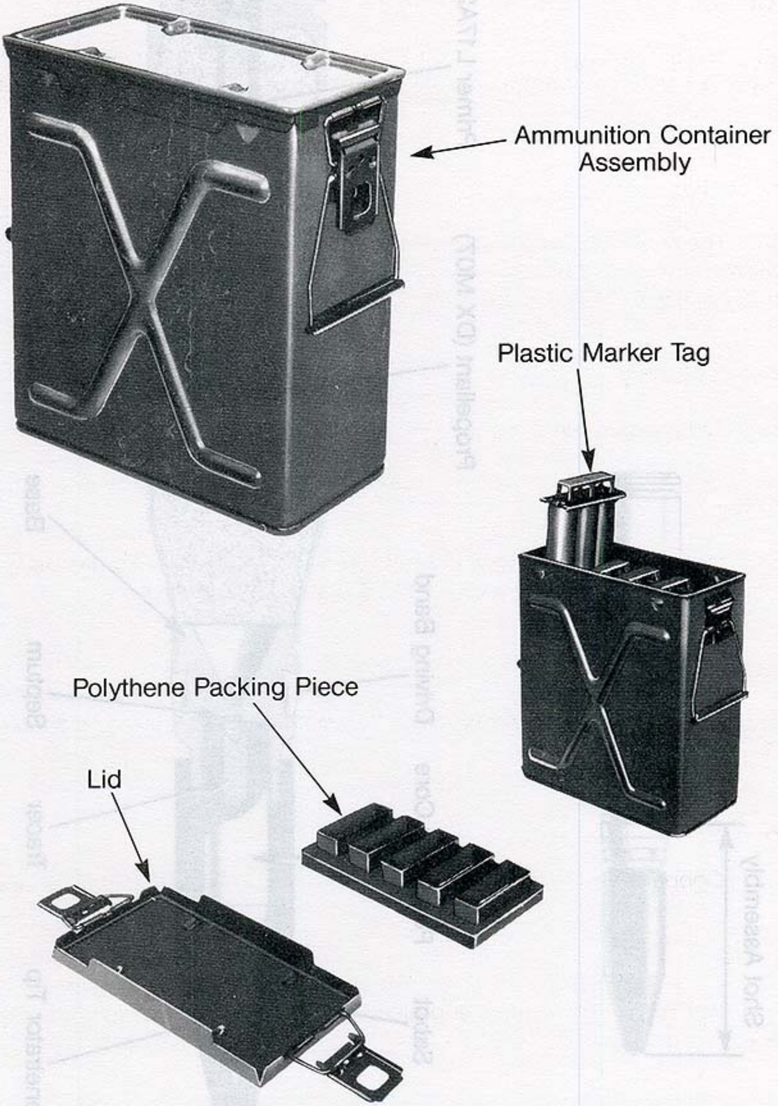

Ammunition Container Assembly
Plastic Marker Tag
Polythene Packing Piece
Lid

Fig 54. — 30 mm Round, Ammunition Container Assembly

SECTION 8. — GLOSSARY OF TERMS

Aim-off

07133. The amount by which the gun is laid off laterally from the centre of the target, usually to allow for the movement of the target or of the vehicle from which the gun is fired.

Angle of Sight

07134. The angle which the line of sight makes with the horizontal plane. The angle is positive (one of elevation) when the line of sight is above, and negative (one of depression) when the line of sight is below the horizontal plane.

Axis of the Bore

07135. The line passing through the centre of the bore.

Blooming

07136. The process by which a chemical film is deposited on the lens surfaces of optical instruments to reduce loss of light due to surface reflection.

Confirmation by Firing

07137. The gun/sight relationship established during boresighting is confirmed by firing.

Coppering

07138. Copper from the projectile driving band left on the surface of the bore.

Drift

07139. The lateral deviation of a projectile from the plane of departure due to its rotation.

Droop

07140. The vertical angle between the axis of the bore at the breech end and the axis of the bore at the muzzle.

Equivalent Full Charge (EFC)

07141. The basis of computing the wear effect of propellant charges.

Fouling

07142. In general, any dirt or moisture on the surfaces of the gun. In particular the waste products left after firing. These products may be corrosive and should be removed as soon as possible after firing.

Jump

07143. The vertical angle between the direction of the axis of the bore immediately before firing and the line of departure. When the line of departure is above this direction, the jump is said to be POSITIVE, when below, NEGATIVE.

Laying

07144. To set the axis of the bore in the direction and at the elevation required.

Line of Sight

07145. The straight line passing through the sight and target.

Mean Point of Impact (MPI)

07146. A point which represents the mean position of the point of impact of a number of projectiles fired at a constant line and elevation.

Muzzle Velocity

07147. The velocity of the projectile two feet beyond the muzzle of the gun.

Parallax

07148. The apparent change in position of the target relative to the graticule when the eye is moved from side to side or up and down.

Piece

07149. Fire-arm (barrel of) artillery weapon.

Quadrant Elevation

07150. When the gun is laid, the angle made between the axis of the bore and the horizontal plane.

Recoil

07151. The rearward movement of the piece on firing, caused by the force of the propellant gases.

Run Out

07152. The forward movement of the piece after recoil.

Setback

07153. The force exerted on certain moving parts in fuze mechanisms, due to their inertia, when the projectile is accelerating in the bore.

Sweating

07154. The indication of the presence in the bore of corrosive products caused by a residue of fouling.

Tangent Elevation (TE)

07155. When the gun is laid, the vertical angle which the axis of the bore makes with the line of sight.

Trajectory

07156. The curve described by the projectile during flight.

07157 — 07164. *Reserved.*

SECTION 9. — TRAINING TESTS

07165. The purpose of the training tests is to measure the standard of safety and handling with the 30 mm gun and the L37 co-axial machine gun. The crew are to be tested as individuals and working as a vehicle crew. In this way instructors can monitor progress during initial training and periodically assess standards within their units.

07166. Commanders and gunners are to be tested by day under normal working conditions. This should be followed by selected tests conducted within a simulated NBC environment. Similarly tests are to be conducted at night or under the appropriate condition in a Training Theatre.

07167. As a guide the following tests are to be conducted in an NBC environment:

- **a.** *State High.*
  - (1) L37 GPMG tests 2, 3 and 4.
  - (2) 30 mm gun tests 6, 7 and 8.
- **b.** *State Black.*
  - (1) L37 GPMG tests 2, 3 and 4.
  - (2) 30 mm gun tests 6, 7 and 8.

07168. It is not practical to carry out the following tests at night:

- **a.** L37 GPMG tests 8 and 9.
- **b.** 30 mm Gun test 2.
- **c.** The crew tests 1 and 2.

Testing

07169. Standards should be measured:

- **a.** At appropriate stages during initial gunner training.
- **b.** On completion of gunner training.
- **c.** Annually in all units equipped with CVR(W)/CVR(T).

07170. The results are to be recorded on the individual soldier's record card.

07171. Gunnery tables for the conduct of annual live firing tests are to be notified.

Conduct

07172. The instructor or an assistant instructor is to act as commander and gunner as appropriate to the NCO or soldier being tested. The soldier under test is not to be penalized as a result of any incorrect actions by the assistant. The test should be stopped and re-taken.

07173. ***Dress.*** Dress is as laid down in SOPs for unit AFV crews or the appropriate dress for NBC states 'High' and 'Black'.

07174. Individuals should be tested in daylight first before being tested at night or under NBC conditions.

Definition of Standards

07175.	***By Day.***	Skilled	— Pass in 30 mm gun and L37 GPMG test 1. Skilled in all other individual tests. Average in the crew tests.
		Average	— Pass in 30 mm gun and L37 GPMG test 1. Average in all other individual tests. Average in the crew tests.
		Fail	— Fail in 30 mm gun or L37 GPMG test 1. Fail in one or more of the other individual or crew tests.
07176.	***By Night.***	As for daylight tests — omitting the individual and crew tests as per paragraph 0783 above.	
07177.	***NBC Environment.***	Skilled	— Skilled in all NBC tests.
		Average	— Average or above in all NBC tests.
		Fail	— Fail in one or more of the NBC tests.

Details of the Tests

07178. Full details of the tests are as follows:

INDIVIDUAL TRAINING TESTS — 7.62 mm GPMG L37A1/A2

COMMANDER AND GUNNER

Test No	Subject	Stores	Conditions	Marking
(a)	(b)	(c)	(d)	(e)
1	Safety	Gun mounted on DP stand	Order the soldier to "Prove the gun"	1. The soldier fails if the safety actions are not carried out correctly. 2. If a fail it would normally mean that further tests would not be conducted.
2	Gun Drills (Action)	Gun mounted on DP stand, one belt of 50 drill rounds	Order "Action"	1. **Standard.** Skilled : No mistakes Average : 1 mistake Fail : more than 1 mistake
3	Fire Order & Reaction	As Test 2	Order "Range, indication, type of target"	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes
4	Immediate Action Drill	As Test 2	1. Order "Guns firing all right, gun stops" 2. After carrying out IA order "Make safe"	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes 2. Errors in stop, make safe are not counted in this test.

(a)	(b)	(c)	(d)	(e)
5	IA & Gun won't cock	As Test 2	1. Gun made safe issue Fire Control Order 2. Order "Guns firing all right, gun stops" 3. When IA has been completed order "Won't fire", "Won't cock" 4. After carrying out the appropriate drill order "Make safe"	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes 2. Errors in stop, make safe are not counted in this test.
6	IA: Obstruction Drill	As Test 2	1. Gun made safe issue Fire Control Order 2. Order "Guns firing all right, gun stops" 3. When IA has been completed order "Guns still fails to fire" 4. After carrying out the stoppage drill order "Make safe"	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes 2. Errors in stop, make safe are not counted in this test.
7	Clear Guns	As Test 2	1. Gun made safe issue Fire Control Order 2. Order "Stop clear guns"	1. **Standard.** Skilled : No mistakes Average : 1 Mistake Fail : more than 1 mistake
8	Stripping & Cleaning	Kit required: 1. 7.62 mm GPMG 2. SPW 3. Flannelette	1. The following drills are to be carried out: a. Prove the gun b. Barrel assembly c. Trigger mechanism assembly d. Recoil buffer e. Return spring assembly f. Piston assembly g. Breech block h. Feed mechanism assembly i. Dust cover j. Correct use and size of flannelette k. Name contents of SPW	1. The purpose of this test is to assess the soldier's ability to strip and clean the gun. 2. **Standard.** Skilled : No mistakes Average : 4 mistakes Fail : more than 4 mistakes or any mistake that affects safety.

(a)	(b)	(c)	(d)	(e)
9	Assembling & the 8 Point Check	As Test 8 and an empty case or 7.62 mm drill round	1. The following drills are to be carried out: a. Action b. Breech block c. Piston d. Piston head friction e. Recoil buffer f. Trigger assembly g. Feed mechanism h. Gas regulator i. Fume extractor	1. **Standard.** Skilled : No mistakes Average : 1 mistake Fail : more than 1 mistake

INDIVIDUAL TRAINING TESTS — 30 mm GUN L21A1 RARDEN
COMMANDER AND GUNNER

Test No	Subject	Stores	Conditions	Marking
(a)	(b)	(c)	(d)	(e)
1	Safety	30 mm gun on stand/CIM or vehicle	1. Order "Prove the gun"	1. The soldier fails if the safety actions are not carried out correctly. 2. If a fail it would normally mean that further tests would not be conducted
2	Recoil System	As Test 1 1. OM 18 2. Petrol & oil injector 3. Hold back tool 4. Cleaning rod (MG) 5. 30 mm cleaning rod handle	1. Check and top up: a. Recuperator b. Buffer system	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes
3	Safety Arrangements	30 mm gun	1. State safety arrangements	1. **Standard.** Skilled : No mistakes Average : 1 mistake Fail : more than 1 mistake
4	Obturation	30 mm gun	1. State how obturation is affected	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes
5	Mechanical Lock	30 mm gun	1. State how the mechanical lock is formed	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes

(a)	(b)	(c)	(d)	(e)
6	Handling Drills 30 mm Gun	1. 30 mm gun on stand, CIM or vehicle 2. Recuperator 3. 6 x 30 mm drill rounds 4. 1 x empty case 30 mm	1. Order "Action" 2. Issue a target description and range 3. Order "Target stop"	1. **Standard.** Skilled : No mistakes Average : 1 mistake Fail : more than 1 mistake or if the mistake involves safety. 2. 'Target stop' is not part of the test and is not marked.
7	30 mm Misfire Drills	As Test 6	1. Issue target description and range 2. Order "Misfire" a. Switches b. Circuit failure 3. Order "Target stop" 4. Instructor will act as gunner or commander as required	1. **Standard.** Skilled : No mistakes Average : 1 mistake Fail : more than 1 mistake 2. 'Target stop' is not part of the test and is not marked.
8	30 mm Misfire Drills	As Test 6	1. Issue target description and range 2. Order "Misfire" 3. Instructor is to set up the misfire: a. Green b. Not Green 4. Order "Target stop"	1. **Standard.** Skilled : No mistakes Average : 1 mistake Fail : more than 1 mistake or if the mistake involves safety. 2. 'Target stop' is not part of the test and is not marked.
9	Clear Gun	As Test 6	1. Order "Clear guns"	1. **Standard.** Skilled : No mistakes Average : 1 mistake Fail : more than 1 mistake or if the mistake involves safety.

(a)	(b)	(c)	(d)	(e)
10	Firing Gears 30 mm Gun & 7.62 mm GPMG	1. Vehicle or CIM and L37 GPMG 2. Remote cocking handle 3. Split collars	1. Order soldier to test 30 mm and L37 firing gears	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes
11	Multi-barrel Smoke Grenade Discharger's Test Electrical Circuit	24 volt bulb screwdriver	1. Order soldier to test SGD's electrical circuit	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes

CREW TRAINING TESTS — L21A1/L37A1/A2
COMMANDER AND GUNNER WORKING AS A VEHICLE CREW

Test No	Subject	Stores	Conditions	Marking
(a)	(b)	(c)	(d)	(e)
1	Strip, Clean & Assemble 30 mm Gun	30 mm gun on stand/CIM or vehicle	1. Prove the gun (breech open) a. Remove recuperator b. Remove the barrel c. Remove toggle and breech ring d. Strip breech ring assembly e. Remove firing pin 2. Clean the gun and its assembly and reassemble the gun	1. The purpose of this test is to assess the crew's ability to strip, clean and assemble the gun, working as a team. 2. **Standard.** Skilled : No mistakes Average : 4 mistakes Fail : more than 4 mistakes or any mistake that affects safety.
2	Sight Adjustment	1. Vehicle with all sights 2. Boresight No 12 3. 7/16″ x ½″ AF spanner	1. State boresight preparation 2. Carry out boresighting as a team of commander and gunner	1. **Standard.** Skilled : No mistakes Average : 2 mistakes Fail : more than 2 mistakes